ARCANA

OF

SCIENCE AND ART:

OR, AN

ANNUAL REGISTER,

OF

USEFUL INVENTIONS AND IMPROVEMENTS, DISCOVERIES AND

NEW FACTS

IN

MECHANICS, CHEMISTRY, NATURAL HISTORY, AND SOCIAL ECONOMY;

ABRIDGED

FROM THE TRANSACTIONS OF PUBLIC SOCIETIES, AND FROM OTHER SCIENTIFIC JOURNALS, BRITISH AND FOREIGN, OF THE PAST YEAR.

WITH SEVERAL ENGRAVINGS.

"How many hints are here thrown out, which, when followed up, lead to the most important results? How many useful suggestions are here offered as to the mode of prosecuting particular discoveries, and how many are roused to exertion by the inter-communication of kindred minds, and supported in their exertions, by knowing that there are others who take an interest in their success?"—Dr. Lloyd's *Address to the British Association*, 1835.

NINTH YEAR.

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MDCCCXXXVI.

ADVERTISEMENT.

In presenting to the Public the Ninth Annual Register of Scientific Arcana, we hope it will be found evident that every exertion has been made to render the present volume worthy of the success of its predecessors.

In the *Mechanical* department, we may point attention to a most ingenious account of the recent improvements in the manufacture of Carpets; the details of the machinery of the Greenwich Time-ball; papers on the application of the compressibility of Water to practical purposes, and of Electro-magnetic Power to Mechanics; the process of Zincography; Mr. Field's evidence before Parliament on Marine Steam-engines; a description of a Wire Suspension Bridge, lately completed at Freyburg; an interesting abstract of experiments on the non-permeability of Glass by Water; notices of improved Steam-engines; and outlines of Manufactures of popular interest, as of Floorcloth, Pens, and Cotton. There are likewise some valuable contributions to the economy of Railways, as the details of the line from Manchester to Liverpool. This division also includes an enumerative report of the British Association; notices of its more important novelties being introduced through the subsequent pages.

In *Chemical Science* will be found an illustrated paper on the structure and origin of the Diamond, by Sir David Brewster; an inquiry into the phenomena of Spontaneous Combustion; the recent experiments in Kyan's process for preventing Dry Rot; the proposed manufacture of Paper from Bog Peat; a beautiful illustration of the evolution of Light during Crystallization; Melloni's experiments to elucidate the nature of Heat, and the same philosopher's observations on the immediate transmission of Calorific Rays through Diathermal Bodies; papers on the duration of Electric Light, and the velocity of Electricity; with notices of New Processes, and New Chemical Facts, reported to the British Association.

In the *Naturo-historical* departments are many important papers. In *Zoology* are some interesting investigations of the transformation of Crustacea, and the anatomy of the Sloth; a proposed New Classification of Animals, by Professor Agassiz; a specimen of the Asiatic Orang-Outang, received in this country during the past year; the singular economy of Pea Crabs; the natural history of the Wasp; the identity of the Parr, or Brand-

ling with a young Salmon; the ingenuity of the Italian Tailor-Bird illustrated; with valuable contributions on Animal Heat and Respiration. Among the Zoological novelties are noticed several Birds and Fishes, a Cetaceous Animal, &c. The notes from the Proceedings of the Zoological Society glance at the additions to the Menagery and Museum during the year; and comprise the very entertaining economy of the Ornithorhyncus, a sterling contribution to our knowledge of nature.

In *Botany* are several new facts in Vegetable Physiology; and a few useful aids to the study of the science.

In *Geology* are noticed the most striking contributions of the year: as the details of Mr. Griffith's Geological Map of Ireland, the result of many years' research and labour; a paper by Professor Agassiz on the Fossil Ichthyology of Great Britain; illustrations of Messrs. Sedgwick and Murchison's Silurian and Cambrian Systems; and Dr. Buckland's notice of the Fossil Beaks of four extinct species of Fishes. Among the phenomena of the year are noticed a terrific Volcanic Eruption in central America; the great Earthquake in Chili; and a Live Toad found in Stone. The Fossil Organic Remains will be found as interesting as they are numerous.

Under *Meteorology* are noticed the Aurora Borealis of November last, in a paper obligingly contributed by Dr. Armstrong, of Vauxhall; who has again furnished the Meteorological Summary of the year. Added to which are notes of the recent appearance of Halley's Comet; and some treasurable Barometrical observations, by Sir John Herschel.

The departments of *Rural Economy* and *Gardening* contain a few introductions and germs of new principles.

The Obituary Notices include some highly respected names, with occasional glances at their principal scientific labours; though, it need scarcely be added, that such notices do not pretend to the minuteness of biographical detail.

Lastly, we present this volume to our patrons, in the hope that each fact of the year has received attention commensurate with its value as a contribution to science, and that no important novelty has been overlooked in the collection and arrangement of the subsequent pages.

LONDON, *Feb.* 20, 1836.

1859

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ENGRAVINGS.

ARCANA OF SCIENCE,

&c. &c.

MECHANICAL AND USEFUL INVENTIONS.

RECENT IMPROVEMENTS IN THE CARPET MANUFACTURE.

The following is abridged from the first Annual Report regarding New Inventions and Improvements in the Useful Arts throughout Europe; ordered by the Society of Arts for Scotland.—By Mr. Edward Sang, Edinburgh, M.S.A.

In the superficial texture of the common carpet, nothing appears to distinguish it from an ordinary web; and a first observer is at a loss to imagine by what means its variety of colours can be produced. On examining the figure more narrowly, it appears that the designer has laboured under considerable difficulties; for in many places where purity of colour would have been advantageous, a mixed colour only is to be found, while scarcely any gradual shading of the tints depending on the nature of the figure is to be seen. A still closer examination explains at once the source of these imperfections. The carpet is found to consist of two contiguous webs, intermingled with each other in such a manner as to produce the pattern: each of these webs, if woven singly, would have a striped appearance, being parti-coloured in the woof. One set of coloured stripes is thus imposed upon another; and in designing the colours of the pattern, no selection beyond what is afforded by the judicious arrangement of these stripes can be made. The number of full colours is thus very limited: these can only be obtained where woof traverses warp of the same colour. To bring up then a part of the figure full red, red warp of the whole breadth must be traversed by red woof of the whole length of the spot; these colours can be immediately concealed by sending the threads to the other web, but were they to remain long there, both webs would become monotonous. It is therefore extremely difficult to avoid a strong tendency to striping in the colours, and, except on the principal part of the figure, the colours can hardly be well managed, the secondary embellishments being almost matter of chance. Yet in the face of all these difficulties, patterns of great beauty are daily formed on the carpet loom.

The invention of the *triple carpet* by Mr. Morton of Kilmarnock, has almost removed these difficulties. This carpet is composed of three webs, which interchange their threads in order to produce the pattern. The primary object in the introduction of the third web, appears to have been the obtaining of greater variety and brilliancy of colouring; but another curious effect has followed, that the two sides of the carpet

are not necessarily counterparts to each other. To a certain extent the figure of the under must depend on that of the upper side, since threads may be needed from the under web to produce what is wanted in the chief pattern, but there still remains the choice of an interchange of threads between the two inferior webs. It is obvious that the tendency to striping must be much less on this than on the common carpet, and that the designer having a far greater choice of colours, may produce effects that could not before have been attempted. It appears that, after the principal figure has been determined on, the skill of the designer is most severely exercised on the wrong side of the carpet. His choice of materials is indeed as great as with the common carpet, but then he is hampered by the restriction in figure, and can only be entirely at ease opposite a flat piece on the right side. The beauty of the triple carpet is at once acknowledged: it possesses almost all the freedom in colouring of the floor-cloth or paper-hanging, while its greater thickness and comparative cheapness bring it into competition with the more expensive kinds of carpeting.

The Brussels carpet is distinguished from the common one by having a raised pile, and by the circumstance that the figures and colours are entirely produced from the warp. The pile is raised by inserting a wire between the body of the warp and the previously raised colouring threads. These threads descend and are fixed by the woof, and after a few repetitions of the process the wires are withdrawn. The Wilton carpet differs only in this, that the pile is made somewhat longer, and cut in the manner of velvet. Were the coloured warp, however, raised into pile at each stroke, the web would have simply a striped appearance; and if it were raised only at intervals, the figure would be given in relief, but would still be merely striped. In order to produce a properly coloured pattern, several coloured yarns are arranged, so that any one of them may be raised into pile between the same two permanent warp threads. Their number is generally five, so that, by their irregular ascent to the surface, the striped appearance is almost broken up. Still, however, the web is essentially striped, and though the designer be not nearly so hampered as in the Kidderminster texture, he is still seriously incommoded in his choice. Let us suppose a board painted in minute coloured stripes. After these have dried, let another coating of coloured stripes be laid on, and so for five coats, each differing from the preceding: the painter may now form an idea of the difficulties encountered by the carpet designer, let him set to work, by scraping away the different coats, to produce a pattern. But there is another annoyance; in order to produce the smallest speck of any particular colour, a thread of that colour must traverse the whole pattern; and that thread may displace some other which would have been advantageously brought in elsewhere. On account of the very different rates at which the coloured threads are taken up, these cannot be wound on one beam, but have to be placed each on a bobbin by itself.

To remedy the inconvenience of this texture, Mr. Whytock contrived his method of partially dyeing the yarns; but we cannot fully understand the value of the contrivance till we have glanced at another kind of carpet texture.

The Turkey carpet is the simplest in its texture of all the carpets, and at the same time is almost unlimited in the choice of colours. Let us suppose ourselves seated at a common loom, and that immediately after having thrown a shot we commence to tie on every thread of the

warp a small bunch of coloured worsted, varying the colour according to our fancy. This completed, let two or three shots be thrown, and well driven up; and then another row of coloured worsteds tied on. It is clear that in this way we could produce any pattern, and that no more any particular colour is wanted than is sufficient to produce the required effect: nay more, the colours being put on by hand, we would not be compelled to reiterate the pattern at each stated distance. Here we have every advantage that we can wish for, excepting this important one, rapidity of formation.

Mr. Whytock's method supplies to all the advantages of the Turkey carpet, a rapidity of weaving greater than that of the Brussels fabric. His method may be described thus:—If for the five coloured yarns of the Brussels carpet we could substitute one yarn dyed of the requisite colour at different places, we would be able to dispense with all the apparatus for producing the pattern, could make the web with only one body, and work it as a simple velvet. The only difficulty would then be in the dyeing of the thread.

In order to dye the thread, one yarn is wound on the surface of a large drum, of which the circumference is equal to the length required for one copy of the pattern. This drum is graduated so that the dyeing roller can be pressed across the yarn at any required place. The design, extended on the ordinary ruled paper, enables the workmen to discover all the places at which a particular colour is to be applied: that done, he changes the colour box, and so proceeds till the whole colouring is completed. The thread is then taken off the drum, and submitted to the processes for fixing and bring up the colours. The next thread is then dyed, and so on till the whole wrap is finished. The next and the most difficult process is, to place all these yarns side by side upon the beam. For this purpose they are wound upon separate bobbins, and small white spots, purposely left in the dyeing, enable the workmen to arrange the coloured parts properly opposite each other. They are then carefully rolled upon the beam, and the weaving proceeds rapidly, each thread being brought into the pile upon every successive wire. Mr. Whytock uses the grooved wires, and cuts the pile in the manner of the Wilton carpet.

Excepting in the necessity for the recurrence of the pattern, this has all the advantages of the Turkey carpet. The coloured spots can be produced at any point, and need not run in rows as in all the others. It need hardly be added, that greatly admired patterns have already been produced by this method; and that the manufacture meets with great and deserved encouragement.*

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The fifth meeting was held in Dublin, from the 10th to the 15th of August; President, the Rev. D. Lloyd, Provost of Trinity College. The following is an outline of the proceedings of the respective Sections.

1. *Mathematics and General Physics.*—The Rev. D. Robinson, President. The first paper presented was by the Rev. Mr. Whewell, on the Mathematical and Dynamical Theories of Electricity Magnetism, and

* Jameson's Journal, No. 31.

Heat.—Mr. Snow Harris read a paper upon a New Balance, adapted to measure most minute indications of force, and to reduce them readily to weights.—Mr. Harris brought forward his peculiar views, and apparatus, for explaining the nature and laws of electrical attraction, repulsion, induction, and "reflection."—Mr. Harris also read and explained some observations made on the temperature of Plymouth, which were contrasted with other observations made at Leith.—Prof. Powell made a communication, concerning the nature of radiant heat, and the possibility of there being at least two kinds of heat, one of which will be transmitted through glass and the other not.—Dr. Hudson read a paper on the radiation of heat and cold.—Captain Sir John Ross, read a paper on the origin of the Aurora Borealis, the result of a twenty-five years reflection on the subject.—Mr. Mallett described an instrument, on the principle of a magnet, formed instantly by electricity, and then again discontinued, for separating the iron and brass, and copper fillings, that become mixed in manufactories.—Dr. Robinson, the president, read a letter from Col. Colby, accompanying a copy of the Ordinance Survey of a parish in Ireland, as a specimen of the grand national work now in progress.—Dr. Allman, Professor of Botany, read a paper on a Mathematical Inquiry into the forms of the cells of plants.—Dr. Reid, of Edinburgh, read a paper upon Sound.—Mr. Russell detailed the origin and progress of the series of experiments on the Resistance experienced at various Velocities, by Bodies moving through Fluids at various rates.—Capt. Sabine explained Hanstein's Theory of the Earth's Magnetic Curves.—Prof. Wheatstone read an account of his experiments on the Decomposition of the Light of the Electrical Spark, produced by different means.—He also made a communication on the various Mechanical Constructions to imitate the Human Voice.—Mr. Fox exhibited his improved Needle for observing the dip of the earth's magnetism at different places.—The Rev. Mr. M'Gauley explained his Electro magnetic Machine for producing Motion.—Prof. Hamilton made a communication on the nature of Algebra, which he defined "to be the science of pure time, as geometry is the science of pure space."—Col. Sykes read an account of a Mode he recommended for taking a rough estimate of the Height of Mountains.—Mr. M'Clean read a paper on Optics.—Prof. Apjohn made a communication on the determination of the Dew Point.—Mr. M'Cullagh offered a beautiful generalization of Planetary Status.

2. *Mechanical Science applied to the Arts.*—Mr. James Rennie, President. Mr. Eaton Hodgkinson reported the result of certain experiments on Impact.—Mr. Mallet read a paper on the Fracture of Bars of Cast Iron.—Mr. Pritchard exhibited an Achromatic Microscope.—Mr. Ettrick read an account of a Mariner's Compass, which by two adjustments, caused the cardinal points on the card to coincide with the corresponding points of the horizon.—Mr. Ettrick read an account of certain improvements in Steam Engines, for rendering availing the steam of high pressure boilers, which is below the pressure of the atmosphere.—Mr. Russell read a paper on the Solids of Least Resistance, with reference to the construction of steam vessels.—Mr. Taylor, the treasurer of the British Association made a communication respecting the monthly reports of the *duty* of steam-engines, employed in draining the mines of Cornwall.—Dr. Lardner then addressed the section on the subject of Rail-roads.—Professor Stevelly described a Self-registering Barometer.—Mr. John Isaac Hawkins, explained on a model, a safe Mode of Turning Corners on a Rail-

read by means of Mr. Saxton's Differential Pulley.—Mr. Cheverton read a paper on Mechanical Sculpture, on the production of busts and other works of art by machinery.—Mr. Grubb made some observations on an improved method for Mounting an Equatorial Instrument.—Lieut. Denham, R.N. made some observations on the Vibratory Effects of Rail-roads.

3. *Chemistry and Mineralogy.*—Dr. Thompson, President.—Mr. Davy read a paper on the best Method of Protecting Iron from the action of salt water.—Mr. Ettrick explained a new Safety Lamp. Dr. Daubeny and Mr. Johnston each explained some new improvements in this most important instrument.—Prof. Kane read a paper on Methyline.—Prof. Johnson submitted a paper on Chabazie, a mineral found in Antrim, and made a communication relative to Isomorphism.—Mr. Fox made a statement relative to the Effects of Iron, when strongly heated, on the Magnet.—Mr. Graham read a paper on the Functions of Water and Ammonia in several Chemical Compounds, and showed some new salts of oxalic acid.—Dr. Daubeny in reference to the disputed point between geologists and chemists, as to the Sublimation of Magnesia, made a communication to the effect, that in the neighbourhood of Mount Vesuvius specimens of carbonate of magnesia were found sublimed within the cavities of the lava.—Mr. Scanlan read a paper on a New Substance, which he had discovered whilst rectifying the vinegar of wood from pyroligneous acid, which differs materially from pyroxalic spirit.—Dr. Dalton read a paper on the Volatile Oil produced by the destructive distillation of Caoutchouc.—Mr. Mallet of Dublin, read a paper on the Flame of Coal Gas.—Mr. Connell described the chemical constitution of Fossil Scales.—Mr. Snow Harris read a paper on the Electricity developed in the Evaporation of Water.—Dr. Newbigging communicated some observations relative to the Effect of Green Colour transmitted through blood.—A communication was made by Mr. Hartop relative to the use of Hot Air in Iron Blast Furnaces in Yorkshire.—Dr. Apjohn read a paper on a mode of obtaining the specific Heats of different Gases.—The next communication was from Dr. Dalton, relative to the Atomic Theory, and the mode of Notation most worthy of adoption by chemists.—Prof. Powell made a communication respecting specimens of some crystallized salts for optical purposes. Mr. Davy detailed at length some experiments for the estimating the comparative value of Virginian and Irish Tobacco.—A communication was made by Mr. Moore on the Corrosion of Lead-Pipes, from the action of organic substances.—Dr. Barker detailed a new mode of Precipitating the Peroxide of Iron from its solutions.—Dr. Geoghegan showed a mode of detecting free Muriatic Acid in Prussic Acid.—Prof. Johnston made a communication on the subject of the Compounds of Gold and Iodine.—Dr. W. Barker mentioned an observation he had made of the appearance of dark spots on a platina wire ignited by voltaic electricity.

4. *Geology and Geography.*—Professor Sedgwick, President.—Mr. Griffith produced his geological map of Ireland, the result of many years' laborious research.—Dr. West read a paper on the geographical position of Cape Farewell.—Archdeacon Verschoyle read a paper on the dykes of the county of Mayo.—Professor Phillips brought forward a memoir on fossil astacidæ, a family of the class crustacea; and read a paper on belemnites.—A paper was read by Lieut. Stotherd, on a granite district in the county of Cavan.—Capt. Denham, R.N., exhibited a map illustrative of the estuaries of the Dee and Mersey.—Mr. Williams read a

notice of some fossil plants, from Bideford in Devon, which had been found in transition strata.—M. Agassiz delivered a lecture on fossil fishes.—Dr. Trail read a paper on the geology of Spain; Mr. Smith, of Jordanhill, a paper on the fossil forest near Glasgow.—Professor Whewell made a communication on the bearing of questions in natural philosophy and mathematics on geological inquiries.—Mr. Hartop read a short notice concerning the Yorkshire coal-field.—Professor Sedgwick and Mr. Murchison then brought forward an elaborate memoir on the stratified deposits in England, inferior to the old red sandstone, and on which they have been occupied four or five years.—Professor Phillips next read a notice on a tertiary deposit on the coast of Yorkshire.—A letter was read from Mr. Lyell, proving that the crag of Suffolk was of two ages, and not one, as has been hitherto supposed.—The business of the section closed by a very brief notice from Dr. Jacob on some diluvial madrepores.

5. *Zoology and Botany.*—Professor Henslow, President.—Mr. Niven submitted a plan for the formation of a natural arrangement of plants. —Mr. Mackay submitted several specimens of bog-timber.—Mr. Nicol read a paper on the structure of the horizontal branches of the natural family of Coniferæ.—Dr. Neele made a communication on the seeming hybernation of a Landrail.—Some interesting observations were made by Professor Daubeny, on the circumstances affecting the exhalation of moisture from the leaves of plants; the influence of light and heat together, and of heat without light.—Mr. P. Marshal read a paper on the zoology of Rathlin.—Professor Allman submitted a plan for the arrangement of plants according to their natural affinities.—Mr. Stannage, of Birmingham, read a paper on the recent discovery of a toad in a sandstone rock in Park-gardens, Coventry.—Mr. Mackay, curator of Trinity College botanic garden, stated that while in the neighbourhood of Killarney, he had seen several full-grown toads. This fact is opposed to the general disbelief of their existence in Ireland.—Dr. Barry read a paper on the dark colour assumed by the sky in the higher regions of the atmosphere.—Dr. Jacob proved that the optic nerve of the eye is in many individuals insensible to certain colours.—Mr. Mackay submitted a polished piece of Irish yew, which furnished a striking instance of the tardiness of growth and great age attained by this species.—Mr. Mackay read a paper on the discovery of several plants indigenous to Ireland, which had not before obtained a place in the catalogue of Irish plants.—A member communicated a method by which to preserve the spines of the Echinus, or Sea Urchin.

6. *Anatomy and Medicine.*—Dr. Roget, president.—The Report of the Dublin Committee on Motions and Sounds of the Heart, was read by Dr. Harrison; and Dr. Williams gave an abstract of a series of experiments instituted by himself on the same subject.—Dr. Graves read a paper on the use of Chlorate of Soda in fever.—Mr. Houston made a communication of a novel and interesting nature "On Peculiarities in Circulating Organs in Diving Animals."—Dr. McDonald read a paper on the Pulse and Breathing from the earliest period of man's existence. —Professor Harrison read a paper on Bones in the Heart of Ruminantia. —Mr. Houston read a paper on Hydatids found in the Omentum of the Axis Deer; and Dr. Harrison read a brief notice of Hydatids, found in the human muscles.—Professor Jacob read a paper on the Mammary Glands in the Cetaceæ: Dr. Collins, a Report of the Lying-in Hospital for the seven years of his Mastership: and Sir James Murray followed, on Atmospheric Pressure as a Remedial Agent.—A report was read by

the secretary for Dr. Roupell, on the effects of poisons in the stomach.—Professor Alison read a paper, On the State of the Arteries in Inflammation.—Mr. Watton, surgeon, of Manchester, described a new operation for the cure of Caries.—Dr. William Stokes read a paper on the Diagnosis between Accumulations on the Chest of Fluids and of Air.—Dr. E. Kennedy read a report on the Purulent Opthalmia of Infants.—Dr. Perry, of Glasgow, read a paper suggesting the existence of an Analogy between Typhus Fever and Scarlatina.—Mr. F. L'Estrange exhibited a new improvement in the Calculo-Fractor used in Lithotrity.—Dr. Corrigan read a paper on the Mechanism of a Peculiar Sound—*Bruit de Soufflet.*—A paper explanatory of his peculiar views of the Functions of the Bowels, was read by Dr. O'Beirne.—Dr. Osborne made an important communication on the Effects of Cold in the Human Body.—Mr. Hutton, surgeon, gave a report of a peculiar case of Disease of the Brain.—Mr. Adams, surgeon, read a paper on Aneurism by anastomosis.—Mr. J. I. Hawkins introduced to the notice of the section Mr. Harrington's Patent Electrizer.—Mr. Snow Harris exhibited the bones of the hip-joint of the celebrated comedian, Mathews.—Dr. Handyside, of Edinburgh, gave an abstract of a paper containing observations and experiments on the Lymphatics, Lacteals, and Veins.

7. *Statistics.*—Professor Babbage, president.—Dr. Maunsell read a paper on the Foundling Hospital of Dublin, and the General Effect of Institutions for Deserted Children.—Mr. Langton, of Manchester, read a report on the State of Education in that town.—Mr. R. W. Gregg's report on the Social Statistics of the Netherlands, was read.—A paper on the Glasgow Bridewell, by Dr. Cleland, was read.—Lieut. Col. Sykes read a paper showing the Rate of Wages in the Deccan, also on the state of Education there.—Mr. Babbage stated his views on the Influence of Co-operative Shops.—Dr. Reid delivered his views upon a plan tried in Edinburgh for the extension of the study of Physics.—Mr. Babbage read an abstract of the Ordnance Survey of the parish of Templemore and city of Londonderry.—Dr. Jones read a long paper on the condition of the Lunatic Asylum in Ireland.—Two papers presented by Dr. Fox, on the Punishment of Death in Norway and Belgium, were read.

At one of the evening meetings, Professor Babbage proceeded to offer some suggestions as to the age of peat-mosses, &c.

The Rev. Vernon Harcourt, general secretary, gave the following account of the recommendations of the Committee, in furtherance of the general objects of the Society:

Mathematics and Physics.—The Committee, after recommending the renewal of many former grants, proposed that small grants be given for constructing tables of the exponents of refracted indices, and organized observations of temperature:—

500*l.* for a duplicate reduction of the Astronomical Observations made at L'Ecole Militaire of Paris.

100*l.* for determining the constant of lunar notation.

100*l.* for observations on the temperature of the tide.

250*l.* for continuing tidal observations in Liverpool and the Port of London.

100*l.* for the advancement of meteorology.

30*l.* for the continuation of Professor Wheatstone's experiments.

30*l.* for reducing to practice Dr. Jerrard's plan for solving equations of the fifth or higher degrees.

It was also recommended that the Association should petition the

government, to send an expedition to explore the Antarctic Regions, and determine as accurately as possible the place of the South Magnetic Pole.

Chemistry.—That 20*l.* should be given to Mr. Johnston for completing his tables of chemical constants; and 30*l.* to Mr. Fairburn for experiments on the hot and cold blasts in ironworks.

Geology.—That 105*l.* should be granted for prosecuting researches into British Fossil Ichthyology; and that the former grants for determining the amount of sediment in rivers, and the relative levels of land and sea, should be renewed.

Natural History.—That the Zoology and Botany of Ireland should be carefully investigated.

Medical Science.—That 50*l.* should be granted for researches into the absorbents; and 50*l.* for examining the sounds of the heart.

Statistics.—That E. Halsewell, Esq., be requested to prepare a tabular return of the inquests held during the last seven years in as many counties as possible; and further to prepare a statistical report of Hanwell Lunatic Asylum. That the heads of inquiry into education issued by the Manchester Statistical Society, should be recommended to those who design to make similar inquiries.

The next meeting is appointed to be held in Bristol.*

SOCIETY OF ARTS.

The Anniversary was held on June 8, when the annual distribution of the premiums adjudged by this Society took place, Vice-Adml. Sir E. Codrington, presiding. The Society have considerably abridged the number of their rewards, and thereby added to their importance; and Sir Edward, after a suitable address, delivered the medals, pallets, &c. to the successful candidates, both for useful improvements and the ablest productions in the fine arts. Several of the subjects had reference to the nautical profession, and afforded the chairman opportunities of descanting on their respective merits. For example, when the ingenious individual was receiving the reward for his jet for an oxy-hydrogen blow-pipe, Sir Edward observed that light produced by it was seen, out at sea, a distance of seventy miles. The following we have selected from the list, as they appeared to us the most important:—

To Ed. Rogers, Esq., Stanage Park, near Ludlow, for his plantations of forest-tress, *the large gold Medal.*

To Mr. H. Powell, 24, Clarendon Street, Somers Town, for his slow motion for the stage of a microscope, *the silver Isis Medal.*

To Mr. H. Goadby, 76, Goswell Street, for his microscope and instruments for dissecting insects, *the large silver Medal.*

To Mr. W. Maugham, Adelaide Street Gallery, for his oxy-hydrogen blow pipe, *the silver Isis Medal.*

To Mr. J. Roberts, 64, Queen Street, Cheapside, for his jet for an oxy-hydrogen blow pipe, *Five Pounds.*

* Condensed from the Repertory of Patent Inventions, No. 21.

To Mr. R. Knight, Jun., Foster Lane, for his experiments on the texture of steel as affecting magnets formed of it, *the silver Isis Medal.*

To Mr. A. Mackinnon, Sheffield, for his permutation lock, *the silver Isis Medal.*

To Master W. J. Flight, 16, King William Street, Strand, for a method of preventing heavy weights from falling when the rope breaks, *the silver Isis Medal.*

To Mr. S. B. Howlett, 83½, Pall Mall, for his crayons for drawing on glass, *the large silver Medal.*

To Mr. G. H. Pearce, 6, Brunswick Terrace, Blackwall, for his relieving stopper for a ship's steering-wheel, *the large silver Medal.*

To Ditto, for his signal lanthorn for ships, *the large silver Medal.*

To Mr. W. Rooke, 30, Union Street, Hope Town, Bethnal Green, for his addition to the jacquard loom for weaving figured silks, *Five Pounds.*

To Ditto, for his frame for brocading silks, *the silver Isis Medal and Five Pounds.*

NEW HYDRAULIC ENGINE.

The Rev. J. T. Porter, of the Close, Salisbury, has, it is stated, discovered a hydrostatic engine, which, if it succeed, will vie with the astonishing power of steam. The principle upon which it acts is the pressure of fluids. The construction of the apparatus is simple, consisting of four cylinders, two of which act as pumps, the other two as working cylinders, each of them having proper pistons. The double acting power (of the model) is put in motion by only twenty-five ounces of water, assisted by the lever. Some idea may be formed of the force of the pressure, when we say that, with the stroke of one of the cylinders of the piston, an ash bough, an inch and a half in diameter, was broken with the greatest ease. The reverend gentleman is very sanguine as to the ultimate success of his discovery, and affirms that a ship, laden with the usual freight, may take a trip to the East Indies and back, the engine requiring for its total supply not more than a half hogshead of spring water.†

THE TIME-BALL, AT GREENWICH.

This apparatus was noticed in the *Arcana* for 1834; the following are the details of its mechanism:—

C, the ball.

A D, a square mast on which it traverses, projecting through the eastern turret *t* of the observatory, and through the centre of the ball.

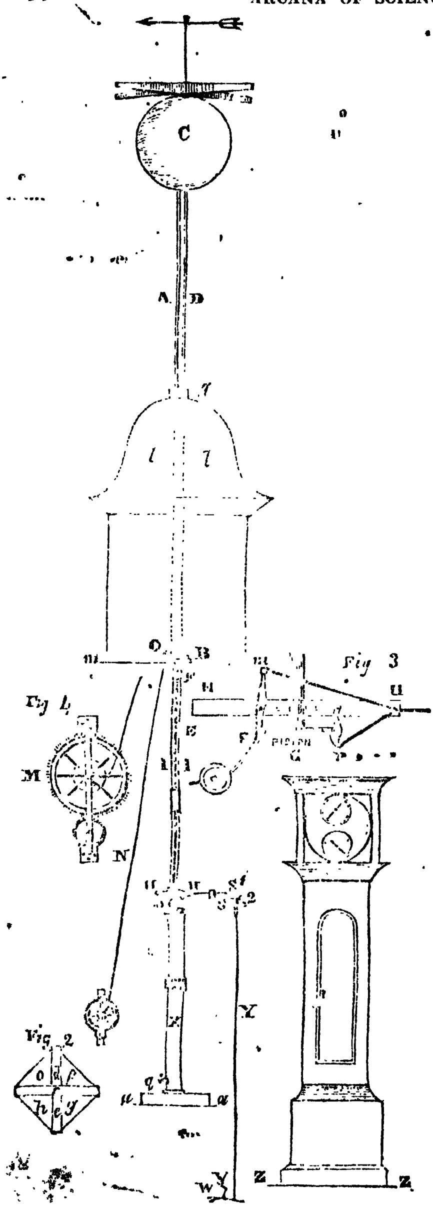
m m, the lead flat of the great room of the observatory.

O B, a circular iron plate in which the mast is stepped, and which is steadied by the roof of the turret at *g*.

F G, an iron rod, to the upper part of which is fixed a part of the mast, and to the lower part the piston G. The upper end of this rod is of larger diameter than the lower.

* Literary Gazette, No. 960.

† Salisbury Journal.



I, an iron cylinder, with a stop-cock at *q*; the base, *a a*, on which it stands being the level of the floor of the great room.

R S T Y, the discharging-rod.

V, the cock, and *w* the trigger, for discharging the ball.

M, the winch for raising the ball.

N, the chain for lifting the ball, and passing over the pulley at O.

H H, a strong iron plate fixed in the wall, on which stand the two iron rods, I I, and which are fixed at the top, in the circular plate O B.

k, these rods guide the piston-rod, and also an iron weight, *k*, (passing through the lower part of it,) to the back of which weight is fastened the end of the lifting-chain N, after passing over the sheave at O.

The construction of the mast, and the manner in which the ball is made to traverse up and down it, is as follows:—

Fig. 2, represents a section of the mast at *d*, which will assist in explaining its construction. *c* is a solid piece of deal, (the whole length of the mast), *d* and *e* two other pieces screwed to it. The three angular parts, *h g f*, thus left are filled by pieces extending the whole length, and firmly screwed in the places; but the part *o* is fitted by a piece, the upper

end of which is secured to the upper part of the ball, and the lower end to the top of the piston-rod at F.

When the ball is down, the weight K, to which the chain is fastened, rests on the iron plate H H, and the top of the piston-rod, F, rests on a projecting piece at the bottom of the weight at L. The chain being fastened to this weight by means of the winch, is made to draw it, and with it the piston-rod and ball.

The piston G being raised (as shown in the figure) to the iron plate H H, forces its way between two detents, P P, which open and close on it, and thus support the ball.

The discharging-rod, R S T Y, has a crank at *s*, with two joints at *s*1 and *s*2. *t* is a box containing a strong spiral spring; the rod Y is secured to the bottom of this box, but the part of the rod above the box T, and below the crank at S, has a short movement within the box, in connexion with the internal spring. The purpose of this spring is, by acting against the ascent of the ball, when it is raised to the masthead, to accelerate its descent when let fall, thereby preventing any adherence to the mast, and giving it rapid motion immediately.

V, the discharging part, has two notches which serve to fix it at half and whole cock, in the same manner as the lock of a gun. When the ball is to be raised, the handle at V is raised to the half-cock; this raises the rod G, and pushes the part R, and prepares the detents P P for receiving the piston, which detents open, and are closed by means of the crank and the spring at T. When V is raised to the full cock it compresses the spring, and exerts a greater force in keeping the detents closed. When the trigger W is pressed down, to discharge the ball, the rod G descends, and draws the part of the rod *r* to the right, which removing the detents P P from beneath the piston, allows it to drop into the cylinder. The piston being adapted to the size of the cylinder, as it descends compresses the atmosphere, and a resistance is thus obtained sufficient to break the fall of the ball with its supporting rod in the mast. A brass cock at the bottom of the cylinder regulates the escape of the atmosphere beneath the piston, so as to allow the fall of the ball to be more or less, as required.

Fig. 3, shows on a larger scale the plan on which the detents are constructed.

When the ball is first raised to the masthead, the weight *k* is at F; for the shoulder of the piston at F resting on the rim of the weight at L, is thereby raised up with the ball. But before the ball is discharged, the lifting-chain is entirely unwound, and the weight K L thereby descends, and rests on the plate H H, in order to give the piston and ball freedom to descend.

During the time that it has been used, the ball has always been observed to commence its descent with 0·2s. after the impulse has been given to the trigger.*

NEW FIRE-ENGINE.

A VERY ingenious and efficacious novelty of this kind has been devised by a M. Vaucher, and called the Swiss Portable Fire-engine, from its resemblance to the machines in which the Swiss, &c. carry liquids for sale on their backs. The form and

* Nautical Magazine, No. 44.

lightness of the engine enable one man to carry it readily on his shoulders to the top of a house, and when worked by two men, it can discharge about twenty imperial gallons of water per minute to a distance of from sixty-five to seventy feet horizontally, and full forty-five feet in height. Modern buildings being now very generally furnished with reservoirs or cisterns on the upper floors, the importance of such an engine upon any sudden emergency is much increased.*

RAILWAYS IN PROGESS.

UNDER the head of Railways now in progress of construction, we find several schemes surpassing in magnitude any that have hitherto been accomplished. Our notice of these must be confined to the most important: the review of which will most appropriately commence at the southern extremity of the great line, proceeding from the shores of the Channel to the north of Lancashire, with the *London and Southampton* Railway. This line proceeds from Southampton, passing near Winchester and Basingstoke, to the north of Guildford, by Wimbledon, to Vauxhall, London, a distance little short of 75 miles; for which the estimate was, as far as we can remember, 1,000,000*l.* From the excessive difficulties of the country, and the consequent heaviness of the works, we should be inclined to suppose it will probably require at least 2,000,000*l.* for its completion. The Act of Parliament was obtained in 1134.

A project, under the name of the *Great Western* Railway, for connecting London with Bath and Bristol, a distance, by the proposed line, of about 120 miles, with an estimate of 2,500,000*l.*, was first entertained two years ago. The eastern termination is on the Birmingham line, about four miles from the station in London. The Act was obtained in the session of 1835, after a contest of almost unexampled severity; and we perceive that the works, some which are heavy, including a long tunnel, on an inclined plane at Box, are in progress.

The next in succession, northward, is the *London and Birmingham* Railway, passing by the valley of the Brent, Watford, Berkhampstead, Fenny Stratford, near Northampton, Daventry, Rugby, and Coventry, to Birmingham, a distance of 111½ miles. The estimate for this line, which, from the nature of the district traversed, must be expensive, is two millions and a half; and the whole distance will, probably, be completed in the course of the year 1838. The works are proceeding with great activity, and, at each end of the line, a certain number of miles will be opened this year, as we learn. There will be several tunnels required to carry the line through the different ridges that cross its course: one of these, at Watford, will exceed a mile in length: an objectionable, but, it is said, inevitable, feature of this railway—the

* Literary Gazette, No. 981.

chief dependence of which must, of course, be on passengers. By this means, however, good levels have been secured, and the distance will easily be performed in five hours and a half.

From Birmingham the line is continued northward by the *Grand Junction* Railway, proceeding from the London Railway by Wolverhampton,* Penkridge, Stafford, to the west of Newcastle, and the Potteries, through Cheshire, to Warrington; at which point it takes up a branch railway already made, and pursues it to Newton, a point on the Liverpool and Manchester Railway, equidistant from these towns. The total length, including the Warrington and Newton line, is about 82 miles; the estimate of its cost, 1,100,000*l.*: it will probably require, including the expenses of a carrying establishment, a million and a half. The district traversed, presents, in general, fewer obstacles than are met with on the London line, and will require no tunnels; there are however, some works of great magnitude at different points, among which may be named the great viaduct across the valley of the Weaver, in Cheshire, consisting of twenty arches, of sixty feet span, and more than sixty feet above the level of the valley. The works are rapidly advancing, and the road, it is expected, will be opened, throughout its entire length, in the summer of 1837. About four hours will be occupied in traversing it.

At Newton another branch line, formerly known as the Wigan Railway, has been incorporated with one at present in progress, which will complete the entire distance of 21 miles, from Newton to Preston, under the title of the *North Union* Railway. The cost of this, including the improvements which must be made in the Wigan and Newton division, will not be much less than 500,000*l.*: the works have already made some progress, and will, it is expected, be completed in 1838. There are a few heavy excavations on the line, and a viaduct, now building across the valley of the Ribble, at Penwortham, which will be a handsome but expensive work.

We find, at the northern end of the North Union Railway, the *Preston and Wyre* Railway, for which an Act of Parliament was obtained last year. It is connected with a proposed extension of the Harbour of Wyre, at the southern side of Lancaster Bay, where, it is hoped, a port of some consequence may spring

* It is intended to carry this Railway over the valley of the rivers Tow and Ouse at Wolverhampton, by a viaduct consisting of 6 elliptical arches, each of 60 feet span, with piers of 10 feet thickness. The arches will spring at about 21 feet 6 inches above the general level of the ground, and the line of the surface of the rails will be about 49 feet above the same surface: the width between the parapets will be 20 feet clear. The abutments will be finished in front with pilasters; the wings will have arched openings, and the extremities of the wings will be finished with pilasters. The rivers will be turned under the arches in a paved channel. The annexed elevation of this viaduct (at page 23,) has been copied from the *Railway Magazine, No.* 4.

up: the distance may be about five miles. This short link completes the communication between our northern and southern waters—a length of nearly 300 miles, the expenditure on which will exceed six millions sterling.

Returning to London we discover, at the foot of London Bridge, the commencement of the *London and Greenwich* Railway; a singular work, conducted, throughout its whole length of 3¾ miles, on a succession of irregular arches, the ground below being already appropriated. The number of these arches will be from 900 to 1,000, averaging 22 feet in height from the ground; the longest structure of the kind, we believe, in the kingdom. The estimate is 400,000*l.*; the works were begun in 1834, and are now far advanced*.

PNEUMATIC RAILWAY.

This affords another instance of the facility with which presumed impossibilities are effected—another case of the ease with which an egg may be made to stand on its small end! The whole secret of the pneumatic system of railway is in the means by which the power obtainable within a close tube or tunnel by the rarefaction of the inclosed column of air, is communicated to a train of carriages on the outside throughout its longitudinal extent, and in the combination necessary to render it effective, the principal feature in which is a perpetually shifting valve.

It happens, fortunately for the ready adoption of the pneumatic system of railway, that practical data are obtainable for determining the efficiency, economy, and extent, of the means and materials it employs. The body of the railway is a cast-iron cylinder, with horizontal rails diametrically opposite to each other, and forming ledges on the sides of the cylinder. The quantity of iron in a given length, and the consequent cost of the cylinders, are ascertainable to a fraction, and the cylinders may be cast in substance as light as possible, since any required degree of strength may be given to the construction by ribs or rings upon the lower semi-circumference at long intervals. The maintenance of fixed steam-engines, such as are to be used as prime movers, or to work the air-pumps, at stations along the line, is a matter of every-day experience; and the working of the blowing-machines, used in blasting iron, furnishes data for the working of air-pumps. We learn, too, that the important pneumatic problem regarding the inertia of air within an extended tube is most satisfactorily demonstrated by efficient practice to be no longer a problem, seeing that the presumed inertia does not exist. Many minor experiments and much relative practice had given fair grounds for abating the presumption; but latterly a system has been introduced, and is now extensively practised by an ingenious mechanical engineer, by which the power of any convenient agent, as a first mover, is communicated to machinery at several miles distant from it, through extended, connecting tubes, merely by the rarefaction of the column of air contained. The difference between the connecting tubes used in this system and those of the pneumatic railway is in favour of the latter,—if there were any thing

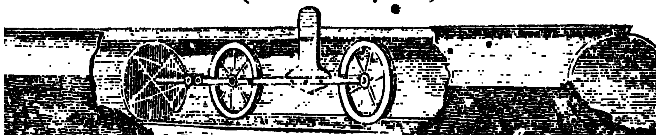
* From a paper in the Athenæum, illustrated with a map of railways; by Mr. James Arrowsmith.

in the presumption above referred to,—because of their greater calibre, and the consequent smaller proportion of rubbing surface in proportion to the column contained. That the tubes are in the former imperforate, and in the latter are perforated and mechanically closed, will not be deemed a difference against the railway system by those who know and can appreciate the secure and really beautiful arrangement by which its pneumatic valve is made efficient. A padded cord, formed upon an iron linked core, and otherwise made flexible, elastic, impervious to the atmosphere under a considerable pressure, and little liable to be acted upon by meteoric changes, is laid down in a trough over the extended longitudinal perforation or chase, through which the communication is effected from the internal apparatus called the Dynamic Traveller, upon which the power is obtained, to the external car called the Governor, to which is attached the train of carriages to be drawn, in the place of the locomotive engine in the common system. The cord, being laid down in the chase, renders the tube or cylindrical body of the railway close, and as nearly air-tight as possible, or certainly as can be necessary; for if the atmosphere be admitted to an extent which shall almost reach the capacity of the air-pumps to withdraw it, still the action of the pumps would, in a few strokes, make the valve perfectly air-tight, by inducing such a pressure of the atmosphere upon the upper quadrants of the cylinder, and upon the back of the cord itself, as to bring them into perfectly close contact. The lifting and laying down again of the valvular cord by the travelling apparatus, to allow of the communication from the internal to the external parts, and to permit, also, the access of the atmosphere to play upon the rear of the travelling piston and give the required impulse, are effected in a manner which is simple and certain.

To obviate the necessity of bringing the cylinders together with any great degree of accuracy, and that common castings may be sufficient for the purpose without the necessity of boring, the travelling piston is allowed to move freely and without packing, and the waste of air is very small; but if necessary, an expanding piston may be found convenient in practice.

It is proposed to divide the line of pneumatic railway into sections of from three to five miles in length, according to the acclivities to be worked, since the steeper acclivity will require a higher degree of rarefaction to be obtained within the same time. High-pressure steam-engines, of sufficient power, at each of the stations which limit the sections, will work air-pumps of sufficient capacity to produce the required degree of rarefaction to overcome the resistance of the load to be drawn within a given time; and the resistance being overcome, the train will, of course, proceed with a velocity equal to that with which the pistons of the air-pumps are worked; aided, and indeed increased, by momentum—"vires acquirit eundo." We should not have thought it necessary to state that the prime movers would continue to work when the train had started—to keep it going after it had been induced to go—

(Section of the Cylinder.)



but what people do fall into misconceptions on the subject! We have seen it seriously stated as an objection, that if a fourteenth of an atmosphere be obtained, the train would run a fourteenth of the distance, and then stop! In truth, however, if the case were as supposed, no such thing would occur; the tractive power, obtained by a certain degree of rarefaction, would fall off in the first yard the train advanced, if it were not kept up by the continued action of the air-pumps.

It is necessary to state, that the cylinder of the railway is intercepted internally at the stations, and so divided into sections by a vertical valve. The presence of this directs the action of the engines upon that section over which a train has to be brought, whilst the engines at the station next in advance are preparing the following section to receive and bear it [illegible]. Hence the withdrawal of the vertical or station-valve allows the on-coming train to pass at once, and without losing its momentum, into the next section, and within the action of the next station of engines, —whilst its return leaves the passed section free to be operated upon again for another train; since, as before intimated, the impelling column of air is admitted by the opening of the pneumatic valve immediately in the rear of the travelling piston, and has not to follow along through the cylinder from the extreme end behind it.

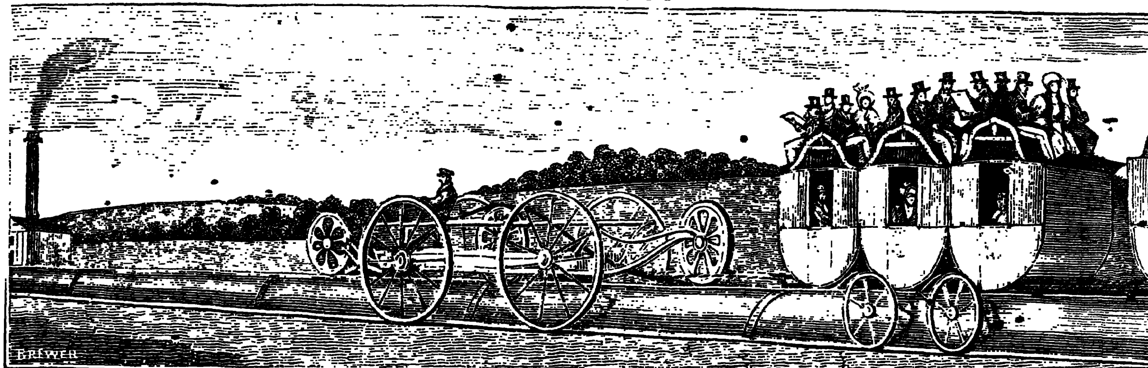
Besides the great economy with which tractive power can be obtained through this system, by the agency of fixed steam-engines, and the certainty and safety with which it is applied, it must be obvious that the system possesses the means, also, of increasing the power as it may be required, if the ordinary working be not at a high degree of rarefaction. But rarefaction to the extent of one inch of mercury only, or about a thirtieth of an atmosphere, will give, upon the piston of a cylinder thirty-six inches in diameter, an amount of tractive power equal to that of an ordinary locomotive engine. Let another inch of mercury be allowed for waste, friction, and other contingencies, and the rarefaction will then amount to only about a fifteenth of an atmosphere; so that there is a range at command, only limited by the economical consideration, whether it be better to maintain, permanently, engines of sufficient power to obtain the higher degree of rarefaction, and the consequent large amount of tractive power, or to limit the acclivities.

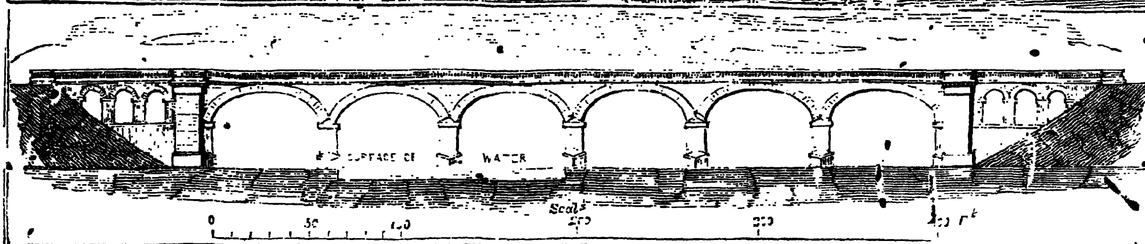
A practical difficulty has been suggested in the application of the pneumatic railway, that it may not be crossed on the surface-level, so that communication from one side to the other of a road formed upon this system must be by bridges over, or tunnels under it. If this be a difficulty, it is possessed in common with the present system of railway, when due care is taken to prevent injury to it and accidents to the public; and we can state it as a fact, that no crossing on the surface-level is contemplated along the whole line of the London and Birmingham railway. Moreover, the pneumatic railway really has an advantage in this difficulty over the common system, that the bridges over it need not be so lofty, as it has no high engine-chimney to carry through.*

The inventer of the Pneumatic Railway is Mr. Henry Pinkus, of North Crescent, Bedford-square, who has patented the same. The details of the Patent are, however, too numerous for quotation, and for them we refer the reader to the *Railway Magazine*, Nos. 3 and 4. The system has been examined by many of our most eminent philosophers, and has the favourable opinion of

* Literary Gazette, No. 965.

The Pneumatic Railway, page 22.





The Wolverton Viaduct, page 19.

many, among whom are Dr. Lardner and Professor Faraday: but, we are bound to state that its practicability has been much controverted.

A model of the Pneumatic Railway has been exhibited in London, and an Association has been formed for its adoption.

The annexed cuts have been reduced from the prospectus of the Association: the first is a section of the Cylinder showing its internal arrangement: the second shows the Railway in operation.

OPTICAL MACHINE.

At the late Meeting of the British Association, Mr. Roberts exhibited a machine which renders objects visible while revolving *200,000 times a minute.*

If a firebrand be whirled, in the dark, round a centre in a plane perpendicular to the eye of the spectator, it will present the appearance of a luminous circle. From this fact it has been inferred, that the impression on the retina made by the luminous body in its passage through every point of the circle, remains until the body has completed a revolution. How rapidly soever the firebrand may be made to revolve, the circle, and, therefore, every part of it, will be distinctly visible: hence a probability arises, that at the greatest attainable velocity, a perfect impression of the object in motion will still be produced on the optic nerve, provided that the time of viewing such object be limited to that which is required for passing through a small space—small, at least, with reference to the size of the revolving body—and also that no other object be presented on the field of vision before the former spectrum shall have vanished from the eye; unless in the case of the same object under similar circumstances. The former of these conditons is provided for in machine, No. 1, in which the eye-hole is made to travel through 180 feet between every two inspections of the moving object, and which object is made to assume a different position at each successive inspection. The latter condition is included in machine No. 2; the object is there presented to the eye in one position only.

VIBRATION OF RAILWAYS.

Capt. Denham has ascertained that the vibrating effects of a passing laden railway train in the open air extended laterally on the same level 1,110 feet, (the substratum of the positions being the same,) whilst the vibration was quite exhausted at 100 feet when tested vertically from a tunnel.

The tunnel was through a stratum of sandstone-rock: the rails laid in the open air on a substratum of 12 feet of marsh over sandstone rock. The method of testing was by mercury reflecting objects to a sextant.*

* Proceedings of the British Association.

OBSERVATIONS ON THE LIVERPOOL AND MANCHESTER RAILWAY.*

By Mr. David Stevenson, Edinburgh.

(*See the Plate.*)

These observations occurred to me during a late professional engagement on the railway under Mr. Mackenzie of Liverpool; and though I do not think it necessary to give a lengthened account of the railway, I trust some of the facts which I have collected will be found sufficiently interesting to excuse me for having brought them under the notice of the Society.

The Liverpool and Manchester Railway was opened on the 15th of September, 1830. Its formation and construction, including the erection of lodges, depôts, and offices, is said to have cost about one million sterling, or at the rate of 33,300*l.* per mile; but as much of the work was not done by contract, this railway cannot be taken as a criterion of the expense of operations of this nature, which now are executed at a much lower rate.

The whole length of the main line is thirty miles. It forms a double way composed of four single tracks of rails, having several branches to towns and collieries on either side. These branches, in most instances, consist of only a single way, with passing places. Connected with the main line, there are many works of importance and interest, including three tunnels, sixty-three bridges, and several cuttings and embankments of great extent. The drainage of Chatt Moss, and the conveyance of the Railway over that bleak and uncultivated tract of country, are also particularly worthy of notice; but as accounts of these works have already been made public, I shall not farther notice them.

Excepting at Whiston and Sutton Inclined-planes, where the inclination is at the rate of one foot perpendicular to ninety-six horizontal, there is no part of the Liverpool and Manchester Railway, more than one in 880; and the curves in no instance deviate from the straight line more than four inches in the chain, or 66 feet. The inclination of one in 880 is hardly felt by the locomotive engines, and the curves are so gentle as to affect their progress very little. But the inclines of one in 96 on the main line, and several of the curves on the branch lines, prove formidable impediments, by diminishing the speed of the engines, and occasionally causing them to stop. The distance between the rails forming the tracks is 4 feet 8½ inches, and the distance between the two railroads or ways is the same. The rails, as shown in the Plate, fig. 4, are of that from technically called *fish-bellied* edge rails; they are made of malleable iron, in lengths of 15 feet, and weigh at the rate of 35 lbs. to the yard. They measure 2 inches in breadth at the top, 2½ inches in depth at the chair, and 3½ inches in the middle. It is worthy of remark, that, when these rails break, the fracture is generally a few inches from the part resting in the chair, and never in the thick part of the rail, between the points of support, which has led to the adoption of the parallel rail shown in Fig. 5, in all cases of repair. This rail weighs at the rate of 40 lbs. to the lineal yard. At every three feet the rails rest in a cast-iron chair, which, including keys and spikes, weigh about 16 lbs. The chairs rest upon stone blocks in the cuttings where the ground is solid, and upon wooden *sleepers* on the embankments, as shown in the plate. The resting blocks contain 4 cubic feet of stone; two holes, 6 inches in

* Read before the Society of Arts for Scotland, 25th February, 1835.

depth and 1½ inch in diameter, are drilled in them, and into these, oak treenails are driven, to which the chairs are spiked. The manner of fixing the chair will be best understood by a reference to the plate. Fig 1 is an elevation, in which *a* is the chair, *b* the rail, and *c* the steel wedge or key with which it is fixed. The lateral motion of the rail is prevented by this wedge, while the recess in the chair, and corresponding *feather* in the rail, obviate any tendency it may have to rise from its seat. Fig 2 is a plan of the chair in which the rail is not shown. Fig. 3 is an end view, in which *a* represents the chair, *c* the spike for fixing it to the treenail, *b* the treenail itself, and *d* part of the stone block. The sleepers are of oak or larch, and contain about 1½ cubic foot of timber; they measure from 9 to 10 feet in length, and being laid across the road, each sleeper gives support to both rails. When sleepers are used, a seat is cut in them for the chair, which is simply spiked down to them. A piece of cloth or *felt* dipped in pitch is generally interposed between the chair and the stone blocks to make the seat more solid. The blocks occasionally split when the treenails are not driven home with care, but the sleepers are most frequently in want of repair and renewal.

The repair and keeping of the way was this year (1834) let by contract for 6,000*l.*, being at the rate of 200*l.* per mile. The contractor furnishes labour, chairs, keys, and spikes, while the Railway Company furnish rails, blocks, and sleepers. They calculate upon having to renew one chair per mile per day, and 120*l.* per annum is taken as the outlay for keys and spikes. The workmen employed in repairing the rails, and keeping the road in order, are called *plate-layers*, and the tear and wear is so great, that there is constant employment found for three men on every mile of the railway. The *ballasting*, in which the blocks and sleepers are embedded, consists of sand and broken stone, and forms a stratum of two feet in thickness.

The Railway Company have had thirty-two locomotive carriages made, five or six of which are now out of use, and many of those at present on the road have been almost totally renewed. These carriages are all numbered and named. No. 1 is called the "Rocket." This engine was made by Messrs. Stephenson the engineers, and is that which did them so much honour in carrying off the prize of 500*l.*, given by the Directors of the Liverpool and Manchester Railway for the best locomotive carriage.* It has been little used, and is still in good repair.

The locomotive carriages used at present on the railway are of three kinds, and are called *train*, *luggage*, and *bank* engines. The train engines average about thirty horses' power. They weigh about eight tons, and cost about 900*l.* The luggage engines are in general thirty-five horses' power, and weigh about nine tons. They cost about 1,000*l.* There are only two bank engines, the "Goliah" and the "Samson," which are used for assisting the trains with passengers and luggage up the inclined planes at Whiston and Sutton. They are about fifty horses' power, weigh about twelve tons, and cost about

* The persons who competed for this prize were,—

	Tons.	Cwt.	Qrs.
Braithwaite and Ericsson, of London, whose carriage the "Novelty" weighed	2	15	0
T. Hackworth, Darlington, "Sans Pareil"	4	8	2
R. Stephenson, Newcastle, "Rocket"	4	3	0
T. Burstall, Edinburgh, "Perseverance"	2	17	0

,100*l*. The cylinders of these different engines measure from eleven to fourteen inches in diameter, and the length of stroke varies from sixteen to twenty inches. The carriages used for conveying water and fuel for the engines are called *tenders*; they have four wheels, and are yoked behind the engines. They average when loaded about four tons weight, and cost about 150*l*. each.

The technical names applied to the different parts of these engines, will be understood by referring to Fig. 6 in the Plate, which is a view of one of Messrs. Stephenson's patent locomotive engines of forty horses' power. In this Plate, letter *a* is the *fire-box*, *b* the *boiler*, *c* the *smoke-box*, *d* the *funnel*, *f* the *cap*, which is made of copper, and contains the end of the steam-tube communicating with the cylinder, *g* the *man-hole*, *k* the *fire-door*, *m* the *framing*, *h* the *wheels*, and *n* the *axles*. The principle on which the boilers are constructed, is simple, and at the same time very efficient. For this invention, it is believed the Railway Company are indebted to their treasurer Mr. Booth. The shell or outside coating of these boilers consists of sheet-iron, half an inch in thickness. Brass tubes, one-eighth of an inch in thickness, and from one to three inches in diameter, are rivetted or fixed into the end plates of the boiler, and being open at both extremities, allow the fire to pass freely through them. By this means a great surface of the water contained in the boiler and surrounding the tubes is exposed to the heat, and the steam is more quickly generated than in the common boilers. The tubes are proved by means of a water pressure of 50 lbs. on the square inch, and, notwithstanding this, they frequently burst. When this accident happens, the engineer stops both ends of the broken tube with wooden plugs. The mechanics connected with the railway prefer the large tubes of three inches bore to the small ones, which are more apt to get choked with soot and ashes. The boilers are generally seven feet long, and four feet in diameter, and contain about seventy or eighty of the small-sized tubes. Round the boiler there is a *lagging* or casing of one half inch deal timber, fixed with iron hoops, as shown in the side view of the engine, which being a non-conductor, prevents the radiation of heat, and greatly facilitates the generation of steam, especially in frost, or in a damp state of the atmosphere. The time required for getting up the steam, even in the most improved boilers, is generally above an hour, when every thing is in a cold state. The Act of Parliament, in consequence of the smoke raised by pit *coal*, enforces the exclusive use of *coke*, which increases the expense of fuel about 40 per cent.

The cylinders are horizontal in all the locomotive carriages, with the exception of two, in which they are vertical, and these are not found to answer so well, and require more repair; the cause of which may be satisfactorily explained in the following manner:—When the cylinders are vertical, the machinery cannot yield to the up-and-down motion of the piston rod, and has consequently to bear the whole shock; while, on the other hand, when the cylinders are placed horizontally, the motion of the piston tends to impel the carriage along the rails, by which the shock is deadened, and has not so injurious an effect upon the machinery. The objection to horizontal cylinders, founded upon the more rapid abrasion of the lower side of the piston by the effect of gravity, is not found to have much force in practice. In some carriages the piston rods are connected to the outside of the two fore-wheels, but in the improved engines they are connected to cranks on the axle of the carriage, in which case the clinders are placed below the boiler, and are quite hidden

from view. On these engines also the wheels themselves are connected by rods, by which means the moving power is applied to four wheels instead of two, which doubles the adhesion of the carriage to the rails. The *cross-head* at the end of the piston rod, working in a slide, produces the parallel motion. I may add, that some experiments were made on the Liverpool and Manchester Railway with Lord Dundonald's rotatory engine, which were of so favourable a nature, as to induce the Railway Company to construct a locomotive carriage on that principle. I have not, however, heard whether their efforts to introduce the rotatory system have proved successful.

The *fire-box*, as in the side view, letter *a*, consists of a double casing of metal, with an intervening space of about 4 inches. This space is filled with water, and has a free communication with the boiler, of which it may be said to form a part. It has a grated or ribbed bottom for holding the fuel, about nine square feet in surface. The *smoke-box* at letter *c* and the *funnel* at *d* are made of iron, and are indispensable for catching the dust and embers blown through the tubes, carrying off the smoke and steam, and causing a draught for the combustion of the fuel. In the improved engines, the waste steam is ingeniously blown into the tender, and heats the water for the supply of the boiler.

The framing in some instances is made of cast-iron, but more generally of wood. It rests upon the axles, and supports all the machinery, together with the boiler and its accompaniments. Connected with it also are the springs for rendering the motion as smooth as possible for the machinery. The carriages have generally four wheels; the "Atlas," however, and some others have six. In some carriages all the wheels are of the same size, and about five feet in diameter, while others have one smaller pair of wheels about four feet in diameter. The naves and rims are of cast-iron, and the spokes and tires of malleable iron. Sometimes, however, the greater part of the wheels, like the framing is made of wood.

It was lately suggested, as an improvement on locomotive carriages, to work the engines more slowly, and to produce the same or a greater speed by increasing the size of the wheels. Wheels of six feet in diameter were accordingly applied to one of the engines, but were found to produce an unsteady motion, and so greatly to increase the liability of the carriage to start off the rails or break down, that they were immediately discontinued. The Railway Company at present allow no wheels more than five feet in diameter to be used on the line. The greatest speed which the engines have been able to attain on a level, is sixty miles per hour, without a load. The Planet engine with her tender went from Liverpool to Manchester in forty-five minutes! being at the astonishing rate of forty miles per hour, including time lost in stoppages and ascending the inclined plane.

During wet weather the engine wheels are found to adhere better to the rails than in dry weather, but if the rails are only damp or *greasy*, the wheels have a tendency to slide instead of rolling, and the carriages then have considerable difficulty in dragging along their loads. According to Mr. Booth's experiments, the adhesion of the wheels, in the most unfavourable state of the rails, is equal to one-twentieth of the weight supported by them. During frost, a loaded wagon is generally placed before the engine to rub off any ice or hoarfrost that may adhere to the rails. After the steam is thrown off, and the *break* or *drag* applied, in order to stop the trains, the time that elapses before they cease to move,

is generally from 40 to 60 seconds, but this depends entirely on the state of the rails, and the rate at which the carriages are moving.

There are generally eight or ten engines at work on the line, each of which makes four trips a-day between Liverpool and Manchester, and on coming in at night the steam is blown off, and the machinery is thoroughly cleaned. At each end of the line the company have a depôt, consisting of sheds, where the engines are repaired at the sight of an overseer or manager, and it is not a little remarkable that 200 men are employed in keeping these engines in good order. The carriages are daily in want of some small repair, but they generally run about eighteen months before receiving a renewal, or thorough repair. The "Vulcan," a train engine, ran no less than 47,000 miles before it required to be taken into the shed for repairs, and the "Fire-fly" ran 50,000 miles. I have never seen any correct account of the work done by the several engines, or the repairs made on them. According, however, to the Railway Company's reports, the expenditure connected with locomotive power, exclusive of outlay for new engines, amounts to the extraordinary sum of about 28,000*l.* per annum. On visiting the Stockton and Darlington Railway in the month of November last, I learned, through the kindness of Messrs. Pease, the promoters of this undertaking, that the engines running on that railway very seldom required repair; although in their construction, and the workmanship employed on them, they fall greatly short of those in use on the Liverpool and Manchester line. But at Darlington the rate of travelling is only eight miles per hour, while at Liverpool twenty-five miles per hour is the usual speed; and hence we are fully warranted in supposing that the great tear and wear on the Liverpool and Manchester Railway may be chiefly attributed to the speed at which the engines are worked. Notwithstanding the smooth surface on which the carriages run, and the judicious use and application of springs, the tremor or shaking of the engines is very considerable, and is much increased with the speed. When moving at the rate of twenty-five or thirty miles per hour, the tremulous motion of the engine becomes quite alarming to those unaccustomed to it.

The luggage-engines perform a great deal of work, and generally bring in twenty loaded wagons, averaging $3\frac{1}{2}$ tons each. With this load they move easily at the rate of twenty miles per hour on every part of the railway, excepting at Whiston and Sutton inclined planes, where the effect of gravity reduces their power two-thirds, and forces them to bring their load to the summit at two, and sometimes three trips, although assisted by the bank engines. They, nevertheless, make the journey between Liverpool and Manchester in about two hours. Upon one occasion I saw the "Fury" engine with twelve loaded wagons, averaging $3\frac{1}{2}$ tons each, ascend the Whiston inclined plane without the aid of the bank engine; its speed on the level was about thirty miles per hour, and when it reached the top of the incline, the velocity was diminished to about two or two and a half miles per hour. This inclined plane is a mile and a half in length, and its rise is at the rate of one in 96.

Some idea may be formed of the load these engines are capable of taking, and of the rate of charges and expense of fuel, from the fact, that, during my stay in Liverpool, the "Atlas" engine brought in forty-seven wagons, being a load of 160 tons, for which the company's charge would be 70*l.* sterling, or at the rate of 1*l.* 10*s.* per wagon. It is, I believe, calculated that the combustion of half a pound of coke will

produce steam sufficient to carry one ton one mile, at the rate of travelling adopted on this railway, so that the conveyance of one ton from Liverpool to Manchester requires about 15 lbs. of coke, the cost of which is about 2*d.* The expense, therefore, of fuel for bringing 160 tons from Manchester to Liverpool, according to this calculation, may be taken at 1*l.* 10*s.*, while the company's charge for carriage is 70*l.*: so that the chief expenditure, after the interest of the first cost of the railway, is in keeping the engines and railway in repair.

The second class train makes the journey in two hours, and has generally eight or ten carriages, which are open, and each seated for twenty-four persons. There are nineteen stations on the line where this train regularly stops, for the accommodation of passengers; and at each station there is a watchman, who makes signals if he sees cause for stopping the train. The signals are made during the day by red flags, and by lights after sunset.

The first class train makes only one stoppage, at Newton, to take in fuel and water, and performs the journey of thirty miles in an hour and a half. The coaches in this train are framed and covered like handsome road-carriages, and are seated for eighteen passengers, with the exception of the railway mail coach, which goes at the end of the first class train [illegible] ated for twelv p[illegible] Th[illegible] Liverpool to Manchester by the first class train in the mail is 6*s.* 6*d.* and in the other carriages 5*s.* 6*d.* In the second class train, the fare by the closed carriages is 5*s.* 5*d.*, and by the open ones 4*s.* The weight of luggage allowed to each passenger is 60 lbs., beyond which a charge is made at the rate of 3*s.* per cwt. The charge for conveying a four-wheeled road carriage is 20*s.*, and a two wheeled carriage 15*s.* One horse is charged 10*s.*, two horses 18*s.*, and three horses 22*s.* About 1,020 passengers and 640 tons of goods are daily transported along the railway.

Each engine carries two men, an engineer and a fireman, who have respectively 5*s.* and 2*s.* 6*d.* per day. As a check upon their regularity, a fine of 2*s.* 6*d.* is imposed on the engineer for every fifteen minutes he arrives *before* his time. There is a *breaksman* with the luggage train, and the trains for passengers carry two guards.

The occurrence of accident is not so frequent as might be imagined, as the great weight of the carriages prevents them from easily starting off the rails; and so great is the momentum acquired by these heavy loads moving with such rapidity, that they easily pass over considerable obstacles. Even in those melancholy accidents where loss of life has been sustained, the bodies of the unfortunate sufferers, though run over by the wheels, have caused little irregularity in the motion, and the passengers in the carriages have not been sensible that any impediment has been encountered on the road. For the prevention of accident, some arrangements have been adopted, by which the north rails are exclusively allotted for engines going towards Manchester, the south being for those going towards Liverpool.

The railway business is conducted by twelve directors, who give a half-yearly report on the income and expenditure; and a dividend of nine per cent. per annum has been declared for payment. At present, the railway is in use only during the day; but by conveying goods during the night, provision may be made for a great increase of traffic, without incurring expense in the execution of new works.

EDINBURGH, 21*st February*, 1835.*

* Jameson's Edinburgh New Philosophical Journal, No. 36.

MANUFACTURE OF FLOOR-CLOTH.

At the Royal Institution, on the 27th of February, Mr. Brande gave a description of this manufacture, and added greatly to its interest by going through the various steps of the process, with the assistance of some workmen employed in the manufactory at Knightsbridge. The main part of the manipulation is similar to calico-printing, the figures on the blocks being upon a much larger scale, and the cloths which are printed being of an infinitely greater size. The common dimensions of a floor-cloth are 210 or 220 square yards, and hence the immense size and often unseemly appearance of floor-cloth works. A stout canvass is chosen in the first instance. This is nailed to one extremity of a wooden frame, and stretched by means of hooks which are attached to the other sides. It is then washed with a weak size and rubbed over with pumice stone. No other substance has yet been found which answers the purpose so well as this mineral. The next step is that of laying on the colour, which is performed by placing dabs of paint over the canvass with a brush, and then rubbing or polishing it with a long peculiar shaped trowel. Four coats of paint are thus applied in front and three on the back of the cloth. To remove it from the frame when these processes are finished, a roller on a carriage is employed, upon which it is rolled and conveyed to the extremity of the manufactory for the purpose of being printed.

It is then gradually transferred from the roller and passed over a table which is 30 feet long and 4 feet wide, made of planks placed vertically, and as it proceeds over the table, the blocks, dipped in the appropriate colours, are applied. The colours used are ochre, umber, vermilion, and different kinds of chrome, mixed up with linseed oil and a little turpentine.

The number of blocks applied to one pattern depends upon the number of colours.

The first mode of applying the patterns was by stencils, that is, the pattern was cut out in paper, and when the paper thus prepared was applied to the cloth to be painted, that portion where the ground was exposed by the interstice in the paper was traversed by a brush. Then a combination of stencilling and printing was had recourse to, the former process being first made use of, and then a block was applied, the stencilling forming the groundwork. Stencilling is now abandoned. In printing, it is necessary that the cloth should first be rubbed over with a brush, else the colours will not adhere. Whether the effect is electrical or not has not been ascertained. Every square yard of good oil cloth weighs $3\frac{1}{2}$ or $4\frac{1}{2}$ lbs. each gaining by the application of the paint 3 or 4 lbs. weight, and hence, the quality of this manufacture is judged of by the weight. Whiting is often used in spurious cloths, mixed with oil. Cloth prepared in this way speedily cracks and becomes useless.

Good cloth, with a very stout canvass, is used for covering verandas, and will last nine or ten years, while spurious cloth will become useless in the course of one year. Floor cloth is employed to cover roofs, as at the manufactory at Knightsbridge, and for gutters. In the latter case it is remarkable that water remaining in contact with it produces no injurious effect.

Painted baize for tables is usually manufactured with a smooth side, and is printed with blocks of a fine structure, resembling calico blocks. Fine canvass is employed; several coats of paint are laid on upon one side, and the other receives one coat, and is then strowed over with wool, or flocked, as it is called.*

ROPE-MAKING MACHINERY.

MESSRS. MACNAB & Co. of Greenock, have published an Exposition of the Principles of Mr. James Lang's invention for Spinning Hemp into Rope-yarns by machinery, and its effect on the strength and durability of Cordage. Of this Exposition the following extract will convey an outline.

"It was only towards the end of the 18th century that the art of Rope-making engaged the attention of scientific men, and began to be conducted on scientific principles. Then it was discovered, that by the mode of operation formerly in use, the yarns could not be brought to bear equally with each other; and, therefore, that a *great loss of strength in the rope* behoved to be the consequence. Great exertions were accordingly made by several intelligent individuals to remedy this defect, and between the years 1783 and 1807, no fewer than twenty-two patents were taken out for improvements in the art, and for machines of various descriptions,—these it is not to our purpose to describe. It may be sufficient to state, that the one invented by Captain Huddart of London, was greatly approved of, and obtained the highest celebrity. This plan was introduced into Greenock in 1802 by the late firm of Messrs John Laird & Co., but was in some measure superseded a few years after by the method now in use, and which, by the application of the same principle, but of a more simple construction, was found to secure the same object, while, at the same time, it was better adapted for general purposes. For this improvement on Captain Huddart's plan we believe we are indebted to Mr. W. Chapman of Newcastle. The principle by which an increase of strength in the Cordage was effected (amounting to about 30 per cent.), is simply by so constructing the strand of the rope as that *every yarn is made to bear its own proportion of the strain.* That the application of such a principle should be followed by such a result, must be apparent to every one, and *it is by carrying out this same principle to its full length,* as we shall afterwards show, that we have been enabled to effect an additional increase of strength, and, consequently, of durability to the rope.

"That a great improvement in rope-making was effected by these gentlemen, there can be no question, but that perfection in the art might be attained, it was still necessary that the mode of preparing the yarns should also be improved. The usual process of hand-spinning was considered very defective, as evidently it did not impart to the yarns that d-

* Thomson's Records of General Science, No. 5.

gree of strength which it was thought the material was capable of affording. Endeavours were accordingly made to obviate this defect also. Three patents were even taken out for machines, but these were found not to answer expectation; those constructed by Mr. Chapman are still used by some houses in England, but as they are very defective, they have never been introduced into general practice. A moment's consideration must be sufficient to convince any person, the least conversant in rope-making, that, if the strength and durability of the rope depend on the proper arrangement and equal bearing with each other of the yarns in the strand, so its strength and durability must also depend on the just arrangement, regular twisting, and consequent equal bearing of the fibrous substances which are employed in the composition of the yarns. Indeed, after the improvement above alluded to, this was the only thing requisite to complete the scientific construction of cordage; and by the application of machinery on a principle somewhat analogous to that which we have already referred to, this desideratum has also been supplied. Mr. Lang, who had for many years directed his attention to the subject, and was convinced of its practicability, upon taking the active management of our works, got a set of machines constructed under his own direction, which, on repeated trial, were found completely to accomplish the object. By this invention, the regular spinning of the yarns which had hitherto been prepared in a tedious and clumsy manner by hand-labour, is one object which has been effected; but this, although in itself important, is one of its least advantages. By the same plan, the hemp, to whatever purpose applied, being drawn over a succession of gills, or small hackles, is dressed in the highest degree; hence the fibrous substances of the hemp are regularly split and subdivided; they are also multiplied to such an extent as that their number in a Patent-spun yarn will be found more than double the quantity of those which compose a hand-spun yarn of equal grist; this, every one will admit, must increase its strength in no inconsiderable degree. Again, while the fibres are thus greatly multiplied, they are also completely elongated and laid straight, so as to admit of being regularly twisted, and each fibre being stretched its full length and laid parallel to the others in the yarn, they are all made to bear at the same time, and equally, in the strain; thus every fibre of the hemp is called into action, and contributes its own proportion of strength to the fabric; this is certainly a most important feature in our Patent plan, and such a result could never be expected from the most careful and best conducted hand-spinning. But this is not all, by hand-labour the hemp can only be spun from the middle, or *bight*; and therefore only one-half of the length of its fibre is extended in the yarn, consequently, some qualities of hemp have hitherto been considered inferior, because, on account of the shortness of their fibre, they would not admit of being doubled: thus, a material in other respects as good, while of lower price, has been rejected in the manufacture of Cordage, not so much on its own account, but because, by the process of hand-spinning, only the one-half of its length could be employed. Now, Mr. Lang's plan has this additional advantage, that the hemp is spun by the end of the fibre, and thus, by having its whole length extended in the yarn, those qualities of hemp hitherto considered inferior, because shorter, may be applied with equal safety and advantage, and do in reality produce Cordage as strong and as durable as the others. When we take into account the very depressed state of this branch of our manufacture, in consequence of the facilities enjoyed by our neighbours on

the continent of underselling us in a foreign market, as also the present state of the shipping interest, it will, by every candid person, be acknowledged that an invention such as this, by which we are enabled to produce a superior article, and at a cheaper rate, ought, even in a political point of view, to be regarded as a public good; and is consequently entitled to public encouragement and support."

Professor Jameson adds:—"We have seen the rope-yarns, understand the machinery employed, have read carefully the exposition, and do not hesitate to say, that this new cordage has answered the expectation of those who have tried it, and that severely too, in many seas.*

CYLINDER BEDSTEAD.

An important and invaluable contrivance, denominated the reclining cylinder bedstead, for which a patent has been recently obtained, and which, on the point of adoption in St. George's Hospital, London, has been minutely inspected and most cordially approved by *written* testimonials, by the whole of his Majesty's physicians and surgeons, and the most eminent practitioners in the metropolis, is one amidst the many brilliant evidences of that astonishing progress in mechanical science for which the present age is remarkable. The inventer is Mr. James Cherry, of Coventry.

The sacking is attached to two cylinders running lengthwise, one on each side of the bed; these cylinders contain several springs upon the chronometer principle, which propel them upon the axles outwards, or right and left from the centre of the bed. The sacking, when the bed is not in use, is always at full stretch, but when it receives the weight of the body, the springs relax, and the bedding is sunk to a concave of twelve inches; the feathers encompassing the patient and relieving the back from the pressure which is imparted to the sides; together with the undulating motion of the springs by which the bedding is sustained, impart a sensation of entire comfort and ease. In the opinion of the faculty, this individual feature presents an effectual preventive of *sloughing* in the back, that dreadful and often fatal consequence of a long continuance in the recumbent posture. The invalid, however helpless he may be, may be placed in any required position, either for his own comfort, or for surgical operation; for example, the body can be raised to any degree; the lower limbs placed on a double inclined plane, a point essential in the reduction of fractures; the feet elevated to assist in replacing a dislocated knee-pan, &c. &c.

By this fortunate invention, the torture which many patients experience from being lifted out of bed, and exposed to the atmosphere while the bed is re-making, or other necessary changes

* Jameson's Journal, No. 36.

effecting, will be utterly obviated, and the expensive attendance of assistants precluded. *One person* can, in the space of two minutes, and without trouble or exertion, *complete an entire change of bedding*—the bed under the patient, bolsters, pillows, &c. all may be swept upon the floor, and replaced by others, and this arrangement is made without inconvenience to the patient, nor is he in this, or any of the other changes, once touched or exposed to sight or cold.

The bedstead is also convertible into an *easy chair*, and can be restored to its horizontal without disturbing the patient or deranging the bed clothes; the bed-rest and pan are brought into use upon a new and most easy principle; the latter is closed by an air-tight, self-acting valve, and all its operations are conducted without the least noise or jarring from the machinery, which is entirely concealed when the bed is made up.

The cylinder bedstead is an elegant structure, in the newest French style, with scroll back and canopy top, that it is not only appleable to cases of sickness, but available for ordinary use, imparting, from its peculiar construction, much greater comfort, with a mere mattress, than is derived from a bed of the softest down when laid upon a bedstead of the general description: in short, it fully justifies the patronage of the most eminent of the faculty, possessing every conceivable convenience, unimpaired by a single objection.*

SPEAKING MACHINES.

At the Royal Institution, on the 8th of May, Mr. Wheatstone gave an account of the different attempts which have been made to invent speaking machines, from the time when the oracular responses were delivered at Delphi, through the period when a speaking head was exhibited by the Pope towards the end of the 10th century, and others afterwards, by Roger Bacon and Albertus Magnus, with the impositions which were practised upon the credulous, to the present time, when the principle of a speaking instrument has been developed by Mr. Willis. Van Helmont was one of the first persons who wrote upon the adaptation of the organs of voice to the articulation of the letters. He considered that the letters of the alphabet constituted the order in which articulate sounds were naturally produced, by the structure of the tongue and larynx; that when one letter is uttered the tongue is in the proper position for the pronunciation of the subsequent one. By attending to the circumstance, that several different sounds are formed, merely by raising or depressing the tongue slightly, as in the sounds Aw, Ah, Ae, A, E, it was easy to produce them by means of a tube with a reed and terminating in a bell. Mr. Willis also effected the same object

* Analyst, No. 10

by using a long tube with a reed, adapted so as to be capable of being lengthened or abbreviated at pleasure. He found, that in the pronunciation of the vowels, i, e, a, o, u, it required to be shortest with the first, and in uttering the subsequent letters to be gradually lengthened. In this way, it was easy to measure the length necessary for each note. When Ae was pronounced, the tube was 1 inch long, Aw 3·8 inches, Ah 2·2 inches, A 0 6 inch, E 0·3 inch.

Mr. Wheatstone exhibited a copy of a speaking machine which was invented in Germany, and afforded a specimen of its vocal powers. The words, *mamma*, *papa*, *mother*, *father*, *summer*, were distinctly pronounced. The instrument consisted of a pair of bellows, to which a tube is adapted, terminating in a bell, the aperture of which is regulated by the hand, so as to produce the articulate sounds.*

RESISTANCE ON RAIL-ROADS.

At the late meeting of the British Association, Dr. Lardner made the following observations on rail-roads. He stated that every road offers a sensible resistance to traction, but this on a rail-road is less, because the surface is more uniform. The resistance on a rail-road to the power of traction is always the same, as the resistance produced by ascending an acclivity, rising one foot in 250; that is, supposing the rail-road to be level. Suppose a rail-road rising 1 foot in 250, resistance to traction then proceeds from two causes,—the resistance on the level, as already explained, and the resistance offered from the actual declivity. The resistance to be overcome on the level is equivalent to nine pounds per ton; and on the road ascending 1 foot in 250, it would be eighteen pounds per ton; and thus it is seen that, in the latter case, the drawing power must exert twice the force necessary on the level. If the road rose 2 feet in 250, the drawing force would be twenty-seven pounds to the ton. This view of the subject is confined to ascents, but it should not be forgotten, that when a rail-road is worked, the transit is from one end to the other. It is necessary, in estimating the merits of rail-roads, to consider their action downwards as well as upwards. In coming down a steep no force is required to impel an engine, and the gravity restores that force in going down which it has robbed from it in the ascent. You have to provide in an ascent of 1 foot in 250, for a resistance of eighteen pounds to a ton, but in descending, no force is required. If it was desired to strike an average between the ascent and descent, the road would present a surface which would be equivalent to a level. This point, respecting ascent and descent, struck the House of Lords, before which he gave his opinion, as

* Thomson's Records, No. 6.

a paradox, but it was one only in sound and not in reality. Dr. Lardner remarked, that these observations referred to ascents not more steep than 1 foot in 250; but supposing the rise to be 3 feet in 250, and where the strain would be, consequently, thirty-six pounds in each ton, would gravity give this back in the descent? It was true that no power was required in descending, but while only nine pounds were gained in the descent, twenty-seven pounds were lost in the ascent. Besides the loss of power, there was also the danger resulting from the too great velocity occasioned by sudden descents. In one of the lines of railway, for which a bill had been applied to the House of Lords, there was a slope of 1 foot in 106, in a descent of two miles and a half long, and the velocity given to an engine on arriving at the foot of the slope could not amount to less than seventy miles an hour. To mitigate defects arising from these abrupt descents, breaks were applied, but not always with success. The break is a piece of wood, pressed against the tire of the wheel by a level, and if it acts with full effect it ought to prevent acceleration. He had seen several cases in which it had totally failed, and one instance which occurred, he would detail. At one of the slopes between Manchester and Liverpool, he was descending with a loaded train of 150 tons. The operative engineer, whether through a desire of displaying the engine's movements, or through neglect, forgot to apply the break at the commencement of the slope; when half-way down, the velocity became so great, that he requested the breaks to be applied, but on doing so, they were instantly burned. The train went down at a tremendous speed, although the supply of steam had been cut off. When the train had been stopped, it was found that the wheels of one of the wagons which revolved with the axis, had been broken, and yet, notwithstanding this accidental drag, the speed amounted to at least fifty miles. It was objectionable to have any slope exceeding 1 in 250, for when the excessive natural powers of gravitation were resorted to, control over its movements was impossible. The conclusion to be arrived at, although it appears paradoxical, is, that you may construct two rail-roads, say of 100 miles in length, one level, the other going over mountains, and yet the two rail-roads may be worked by the same mechanical power. Suppose in the one you ascend 1 in 250, and descend in the same ratio, a pull of eighteen pounds to the ton is required only fifty miles, and on the other half you descend by inertion. On the level road, a pull of nine pounds to the ton is required, from the entire distance of miles, and thus the extent of exertion is equalized. It was not, however, to be forgotten, that they should have a regard to the power used. If the power to be used was that of animals, then it might happen that the hilly road would be better than the level; for nothing was better understood than that a dead and unvarying pull upon the same set of muscles, would have the effect of causing the

labour to be more severe, while a varying pull would alternately give quiescence and exercise to the muscles. If the line was so disposed as to throw the whole ascent in one spot, the advantage would be gained of having the rest of the road nearly level. But the cost of attaining this advantage should not be forgotten. Steeps of this description required an increased power, and the engines capable of working on the general line of road would not be capable of exerting an increased force. There were only two ways of ascending sudden ascents, one by the agency of an additional engine, and the other by having the whole train pulled up by means of a rope. The additional engine would occasion much additional expense, for the supply of them would always be preserved, and the men should be paid their wages whether wanted or not. The use of the rope would occasion an enormous waste of power; and he mentioned the instance of a place, where on ascent of 1 foot in 136 occurred. The rope was five miles long, and its weight was 60,000 pounds. Dr. Lardner next referred to one point on which he seemed to consider that engines generally were at variance with what was correct. He contended, that the heat of the fire is directly proportional to the quantity of the steam allowed to escape in a definite time into the flue, and consequently that half the number of blasts of steam projected into the chimney in an engine going up a hill, would have the same effect in exciting the fire as double the number of blasts of half the condensation, when the engine was running on a level plane.*

APPLICATION OF THE COMPRESSIBILITY OF WATER TO PRACTICAL PURPOSES.†

By James D. Forbes, Esq., F. R. SS. L. & E., &c.

ONLY two methods have been applied with much success to the *precise* determination of pressures communicated in all directions; the one, by observing the volume of air inclosed in a tube, as in the common manometer; the other, by the actual measurement of the height of an equi-ponderant column of fluid such as mercury. Each of these methods is subject to grave practical inconvenience: in the case of the manometer, from the immense disproportion of the division of the scale for great variations of pressure, and, in the other, from the extremely cumbrous and unmanageable apparatus which it requires when the pressures are considerable. Both these methods were resorted to by the Commission of the Institute of France, appointed to ascertain the relation of the temperature and pressure of steam, the pressure being ascertained by the volume of air in a manometer,

* Jameson's Journal, No. 38.

† Read to the Society of Arts on 22nd April, 1835.

previously graduated experimentally by comparison with the pressure of a column of mercury.

The idea of substituting a manometer constructed of water instead of air, occurred to me a considerable time ago, when applied to by a friend to suggest a form of guage for measuring the pressure of condensed gas intended to be used for a furnace. I had recently been making experiments with the very convenient compression apparatus of Oersted, in which the changes of volume of water and air are exhibited at once, under any pressure, that of the water being sensibly uniform for equal increments of pressure, whilst that of air rapidly diminishes.

It is the very trifling compressibility of water (or any other liquid) which gives the value to this application, and which seems to have been practically overlooked.

The reason is obvious. The changes of volume produced by a pressure of only one or two atmospheres, in the case of air, are quantities very large in proportion to the primitive volume, so that, in the consideration of an additional change, we are obliged to take into account not merely the effect upon the primitive volume, but upon the volume affected by the first unit of pressure. In other words, we are not at liberty to neglect quantities of the second order, which we may safely do in the case of any known liquid. In the case of water, for instance, the variation of volume for one atmosphere does not exceed $\frac{1}{20,000}$ of the whole; so that the variation of the variation is necessarily insignificant. All that we know of the constitution of liquids, would lead us to infer, that such would be the case, and upon this circumstance depends the *linearity* of the expression, which connects the volume of a liquid such as water, and the pressure to which it is subjected.

Within ordinary practical limits, we may confidently anticipate the sensible proportionality of pressure and change of volume; and this is fully borne out by a comparison of the best experiments on the compressibility of water made within great and within narrow limits.

I did not hesitate, therefore to recommend the trial of a manometer of water instead of air, for measuring the elasticity of gas up to 10 atmospheres of pressure.

The construction of such an instrument being almost like that of the common thermometer, is incomparably simpler than that of the other instruments above mentioned; and almost the only practical difficulty is common to all these, namely, the accurate determination of the temperature of the fluid employed.

It may be proper to remark, that Professor Oersted's instrument for indicating the compressibility of water, consists merely of a very sensible thermometer, constructed of water, and having the end of the tube left open. The tube being capillary, a short column of mercury rests on the surface of the water, indicating its volume at any moment; and the whole is immersed in water,

contained in a strong vessel, to which pressure is any how communicated, so that the thermometer-shaped vessel of glass being equally pressed within and without (the neck being open), is unaffected by pressure, and the true change is perceived in the volume of water which it contains.

The applications of this form of instrument are very numerous; we may take as examples,

1. The determination of the tension of gas or air in a compressed magazine, as I have just suggested.

2. The measure of elasticity of high-pressure steam.

3. The determination of the degree of compression under which bodies change their state, when such experiments can be performed in glass vessels, as in the case of the condensation of the gases into liquids, the pressures as stated by different authors varying extremely, and being confessedly imperfect approximations.

4. The ready determination, by inspection, of the pressure per square inch exerted by Bramah's press at any instant.

Nothing could be easier than to convert the instrument as above described into a self-registering one, by simply inserting an index of glass, which may be drawn back by the little mercurial column, just as in Six's thermometer. We should thus be enabled to determine the operation of causes by their nature concealed from direct view; as,

5. The force exerted by water in the act of freezing, in a manner much more direct and satisfactory than that of the Florentine Academicians, because it would not be necessary to cause the recipient to burst. the maximum expansive force being indicated by the register.

6. The force of fired gunpowder; and even of dead pressure and of percussion in a variety of cases.

7. The depth of the ocean by the measure of the pressing column, the instrument being attached to the sounding-lead. I have been informed that the ingenious Mr. Perkins proposed this application of the compressibility of water which naturally arose from his method of ascertaining the *fact* of compression by using the pressure of the ocean, though no notice of this is taken in his paper in the Philosophical Transactions. The Piezometer there described was like Oerted's instrument, intended for measuring *compressibility* not *pressure*.

In these cases, a Register Thermometer would need to accompany the self-registering instrument. Probably no considerable error is to be feared from abrupt changes of volume to which the water might be subjected, for the coincidence of the velocity of sound in water, theoretically deduced from its modulus of elasticity, and experimentally by M. Collador, seem to prove that little or no heat is developed during its compression.

The accompanying thermometer would, of course, require to be itself protected from the disturbing influence of pressure.

The extensibility of the glass vessel containing the water

under pressure, might be applied to give an independent confirmation of the first result; and elegant practical constructions might be pointed out by which these separate results might be obtained, and also the effect of temperature eliminated.*

BALDWIN'S LOCOMOTIVE ENGINE.

(From the Report of the Committee of Science and Arts, to the Franklin Institute).

THE committee having examined several of these engines, which are now being built in Mr. Baldwin's workshop, (Philadelphia), found in them numerous improvements, affecting nearly every part of the machine. The first they will notice, is in the position and construction of the force pumps, which supply water to the boiler; the guides of the piston rods are made hollow, and the cavities are used for the chambers of the force pump, thus giving additional strength to the guides, without much increasing their weight, and dispensing entirely with the frame and fixtures of the ordinary force pumps. Each of these pumps is furnished with five valves, three of which are situated between the boiler and the piston, and two between the piston and water-tank. The valve nearest the boiler is loosely swivelled to a stem, passing through a steam-tight collar in the top of the valve box, by means of which the valve can be sounded, and, in most cases, freed from obstructions.

The other four valves are contained in one box; this box is secured to the pump by a stirrup, which can be removed by loosening a single screw, so that the valves can be taken out, cleansed, and replaced, in a few minutes. By thus increasing the facility of examining and cleansing the valves, and thereby diminishing the liability of the force pumps to obstruction, the supply of water to the boiler will be rendered much more regular and certain; and the chief cause of those fearful explosions incident to steam-engine boilers, will be in a great measure removed, as it is confidently believed that these accidents are generally the result of a deficiency in the supply of water.

Another improvement consists in the manner of reversing the motion of the steam valves. This is done in the English engines by means of a tradle, and a series of levers, which move the eccentrics laterally on the propelling axle, after the hooks of the eccentric rods are thrown out of gear with the rock-shafts. In Mr. Baldwin's engines, the arms of the rock-shafts extend on opposite sides of the fulcrum, and each eccentric rod is furnished with two hooks, turned in opposite directions, so that it may be geared to either arm of its rock-shaft; the eccentrics are fixed immovably upon the axle, and the eccentric rods,

* Jameson's Journal, No. 37.

instead of being carried (as they usually are) to the front of the engine, are brought to the stage at the hinder part, and there geared to either arm of the rock-shafts, at the option of the engineer. When the hooks of the eccentric rods are geared to the same arms of the rock-shafts as the valve rods are, the motion of the valves corresponds to that of the eccentrics; if they be geared to the opposite arms, the motion of the valves will be reversed: and if they be not geared to either arm, the rock-shafts and steam valves can be worked by the hand levers. The advantages of this arrangement are several: the eccentrics being firmly secured to the axle, are less liable to get loose, and out of repair; it dispenses entirely with the treadle, and its appendages, and also with four rock-shafts, and the complicated hand gear of the English method.

But the most important benefit is, that the rock-shafts and eccentric hooks are placed immediately under the eye, and within the reach of, the engineer, which is not the case in the ordinary arrangement.

The axle of the driving wheels has also been made the subject of improvement by Mr. Baldwin. Instead of fixing the ends of the axle into the centres of the wheels, as is usually done, he dispenses with one of the arms in each crank, and fixes the wheel upon the wrist of the crank, with its centre adjusted to the centre of the axle. By this change in the form of the axle, the power of the engine is applied directly to the wheel, without the intervention of an arm of the crank, thus diminishing the strain upon the axle, and, consequently, lessening its liability to be broken. By this means, also Mr. Baldwin has, in some measure, obviated the tendency of the driving wheels to twist upon the axles, and become loose; a very general and troublesome defect of locomotives. Another good effect resulting from this change, is, that the distance between the two cranks is increased about ten inches, which will admit of a corresponding enlargement of the boiler, and of a more advantageous disposition of the weight of the fire-place, by bringing it about fourteen inches nearer to the axle. In these engines, the steam pipe is introduced into the boiler through the opening by which it usually communicates between the dome and the cylinders; and the end of the pipe beneath the dome is supported on a horse, fixed within the boiler, so as to admit of its longitudinal expansion and contraction by changes of temperature; and to avoid inconvenience from the same cause, the stop of the throttle valve is fixed on the steam pipe, instead of the head of the boiler. A twofold benefit is derived from this plan of introducing the steam pipe: first, the pipe may be made without a joint within the boiler; and secondly, a man hole in the boiler may be dispensed with; for the juncture between the dome and boiler, as well as all the other steam joints, being accurately fitted by grinding, and formed without any cement, or packing, the dome can easily be taken

off and replaced, and its aperture used for occasional access to the inside of the boiler.

In the construction of his driving wheels, Mr. Baldwin uses hubs and spokes of iron, cast in one piece: felloes of hard wood are framed into the ends of the spokes, and the whole is firmly bound together by a stout tire of wrought iron, with a flanch on its inner edge; thus, by a judicious combination of iron and wood, he has united the strength and firmness of the former, with the elasticity of the latter, so desirable in the tread of the wheels.

Mr. Baldwin has completed several engines, which combine all these improvements; one of them may be seen in operation on the Philadelphia and Trenton Rail-road, and four on the state road to Columbia; all of which, as well as one in use at Charleston, South Carolina, have given entire satisfaction by their performance.*

EFFECTS OF HOT AIR IN SMELTING IRON.

ON March 16, Dr. Clark of Aberdeen, read before the Royal Society of Edinburgh, a paper on this important subject, the substance of which is as follows:—

The author first gives a general account of the process of manufacture of cast-iron previous to the recent improvements, stating the quantities of the various materials put into the furnace, namely, of the Ore, the Coal, and the Flux. He next states the method suggested first by Mr. Neilson of Glasgow, and tried at the Clyde Iron-works, for increasing the product of the furnaces with the same expense of materials, which consists in previously heating the air thrown into the furnace, in order to accelerate combustion. The method is found to produce a vast saving both in the fuel and the flux, although a certain portion of fuel has, of course, to be separately consumed for the purpose of heating the air, which is done by causing it to traverse a recurved pipe placed within a suitable furnace. During the first experiments, in 1830, the air was heated to 300° Fahrenheit. In 1831, Mr. Dixon of the Calder Iron-Works thought of substituting raw coal for the coke which had hitherto been employed for fuel, at the same time that the air was still farther heated to 600° Fahrenheit, and with complete success. The result is, that *three times as much iron is now made by the use of a given weight of coal as formerly.* The following are the results of the experiments made at the Clyde Iron-Works.

In 1829, 111 tons of iron were produced from 403 of coke, or 888 of coal.

1830, 162	376	886
1831, 245		554

Dr. Clark endeavours to point out the source of advantage thus

* Quoted in the Mechanics' Magazine, No. 620.

obtained, from the enormous quantity of air which is thrown into a furnace in full action, which is not less than six tons weight in a minute, and which, therefore, must exercise the most important influence upon the mean temperature of the furnace.*

ON THE APPLICATION OF ELECTRICO-MAGNETIC POWER TO MECHANICS.

By M. J. D. Botto, Turin.

THE singular energy with which magnetic action is developed in soft iron, under the influence of electricity in motion, is well known.

As the possibility of applying this new power to mechanical purposes involves a subject of much interest, I have been induced to make known the results which I have obtained.†

The mechanism which I employed consists of a lever put in motion, after the fashion of a metronom, by the alternate action of two fixed electrico-magnetic cylinders, operating upon a third cylinder which is movable, and attached to the lower arm of the lever, whilst the superior arm maintains a constant swinging movement; which is regulated, in the ordinary method, by a metallic wheel.

The apparatus was so disposed, that the axes of the three cylinders, all perfectly equal, being situated in the same vertical plane, and perpendicular to the axis of motion, the oscillatory cylinder, by one of its extremities, alternatively came in contact with, and in the direction of, the one or the other of the other two cylinders, placed at the extreme limits of its movements: and each time, at this very instant, the direction of the magnetizing current in its spiral was changed, the rest of the circuit maintaining the same direction, so as to produce poles of the same name with those in the fixed cylinders, at the two extremities, situated in relation with the moving cylinder. The change of direction, which we have just been mentioning, is obtained with the help of a piece of mechanism, on the principle of a balance, and known under the name of a *Bascule*, where the very movement of the machine itself inverts the communications.

It is clear that, on account of this arrangement, the middle cylinder must undergo alternating agreeing influences of attrac-

* Jameson's Journal, No. 37.

† I may here remark, that the expectancy of giving a wider range to my experiments, and also my being under the necessity of leaving town, have produced considerable delay in the publication of these facts. I have now, however, determined to announce them, from having seen in the last number of *Gazette Piemontaise*, that M. Jacobi of Konigsberg has succeeded in obtaining perpetual motion simply by means of electrico-magnetic influence.

tion and repulsion, in virtue of which the mechanism puts itself in motion, to all appearance spontaneously, and so actively maintains it, by the arrangement of the magnetic forces which incite it, and which are sustained by the electrical currents.

I have tried to succeed without the spiral of the middle cylinder, by making the two fixed magnetized cylinders alternately act upon it. An adhesion, however, which continued after the cessation of the magnetic currents, very much diminished the mechanical effect, whilst, on the other hand, in the other arrangement, the adhesion not only ceased, but was converted to a certain extent into repulsion, with a rapidity equal to that of the current itself, which, scarcely for an instant interrupted by the play of the (*bascule*) pendulum, precipitated itself (the communication being inverted) into the spiral of the middle cylinder, in a contrary way to its former direction, at the same time resuming its ordinary course in the other two spirals.

The movement of the lever, and of the regulator, resulting from this arrangement, is perfectly free. Commencing slowly, it speedily and by degrees acquires the maximum of the velocity which the energy of the currents which produce it allows of, a velocity which is then maintained as equally as the intensity of the current itself, and as long as the electrical influence is preserved.*

On the present occasion I shall say nothing concerning some observations I had made upon the employment of various acid and saline solutions, and also of sea-water.

Much interest is excited by the contemplation of these novel effects of a power, which exhibits itself in a manner so different from that seen in most other bodies; and we are almost tempted to anticipate flattering results from those ulterior applications, to which the management of this mysterious agent may lead.†

The dimensions of the apparatus just described are very inconsiderable, and such that the current arising from fifteen plates, 9 inches square, can produce the movement. The electro-dynamic cylinders, which principally determine the limits of the mechanical effect, are 4 inches in length, and about half an

* There is a great similarity, both as it regards the general arrangement of the apparatus and the nature of the moving principle, between the mechanism of M. Botto and the electrical clock of M. Zamboni. This clock is put in motion by a pendulum, which is alternately attracted and repelled by the poles of two dry galvanic piles, which are known under the name of Zamboni's piles.

† The Chevaliers Avogrado and Bidare, who have both seen the apparatus in movement, have given expression to their surprise, not so much on account of the novelty of the fact, as on account of the speculations it suggested to those able men, respecting the general connexion which might subsist between this simple result and the progress of science and mechanism.

inch in diameter; they are surrounded by a spiral thread 130 feet long, of the thickness of about the fiftieth of an inch. The lever is of wood: the superior and inferior arms are respectively of the lengths of 14 and 3 inches; the extent of the oscillations is 15 degrees. In fine, the regulator weighs about 5 pounds, and the entire weight of the whole is about 11 pounds.

Considerations, which readily offer themselves on a comparison of the maximum magneto-mechanic effect of this apparatus, and the size of its different parts, have suggested the substitution for the cylinder of the ordinary horse-shoe form of electrico-magnetic bars, and the augmentation, within certain limits, of the number and size of these bars, and also of the length of the spirals.

As I have not finished my experiments on this subject, I shall at present confine myself to the statement of the foregoing facts; which I have thought it expedient to publish, not only on general scientific grounds, but also because the study of the new kind of effects to which it belongs, may be considered as fruitful of important mechanical results.*

MANUFACTURE OF PENS.

At the Royal Institution, on March 27, Dr. Faraday delivered the following paper on the manufacture of pens:

Quills appear to have been employed, at least, as early as the seventh century. England is supplied with this article from Russia and Poland, where immense flocks of geese are fed for the sake of their quills. The quantity exported from St. Petersburgh, varies from six to twenty-seven millions. Twenty millions were last year imported into England from these countries. We may form some idea of the number of geese which must be required to afford the supply, when we consider, that each wing produces about five good quills; and that, by proper management, a goose may afford twenty quills during the year. Hence, it is obvious, that the geese of Great Britain and Ireland, could afford but a very limited supply. The feathers of the geese of the latter countries are employed for making beds.

The preparation of quills, or *touching* as it is called, is a curious and nice process. The Dutch possessed the complete monopoly of the quill manufacture until about 70 years ago, when the process was introduced into this country, and now our quills are infinitely superior to those of Holland.

The quills are first moistened, not by immersion, but by dipping their extremities into water and allowing the remaining parts to absorb moisture by capillary attraction. They are then heated in the fire or in a charcoal choffer, and are passed quickly under an instrument with a fine edge which flattens them, in such

* Jameson's Journal, No. 35.

a manner as to render them apparently useless. They are then scraped, and again exposed to heat, when they are restored to their original form. This is a remarkable fact, and deserves to be attended to. It may be illustrated by taking a feather and crushing it with the hand, so as to destroy it to all appearance. If we now expose it to the action of steam or a similar temperature, it will speedily assume its pristine condition.

Many of the quills, after this preparation, are cut into pens by means of the pen-cutter's knife, and are also trimmed. A pen-cutter will cut in a day, two-thirds of a long thousand, which consists of 1,200, according to the stationers' computation. A house in Shoe-lane, cuts generally about six millions of pens, and last year, notwithstanding the introduction of steel pens, it cut many more than it had done in any previous years. According to the calculations of the pen-makers, not more than one pen in ten is ever mended.

About thirty-one years ago, Mr. Bramah introduced portable pens into this country from New York, and took out a patent for their manufacture. The process for making portable pens is to form a vertical section of the barrel of the quill and polish the pieces. The pens are then cut with a beautiful instrument, each quill affording six pens. When they have been nipped coarsely, a polish is given with the pen-knife. Sixty thousand of these pens are manufactured weekly by two houses. An attempt was made to apply steel tips to portable quill pens, but the success which was anticipated did not follow.

Metallic pens appear to have been first introduced as rewards for merit, but steel pens for writing were first made by Mr. Wise, in 1803, and were fashioned like goose pens.

A patent was taken out in 1812, for pens with flat cheeks, and in this way all metallic pens were made for some time, as the rhodium pen of Dr. Wollaston, and the iridium pen of others. About twelve years ago, Mr. Perry began to make pens, and about six years ago they began to be manufactured at Birmingham. The steel is pressed into thin sheets by a rolling press. It is then cut into slips, annealed for fourteen hours, and again passed under the roller. By means of a peculiar cutting-machine the pens are formed in a falchion shape. But one-half of the steel is thus wasted, and no use has been found for it. It is so thin that it cannot be welded, and it cannot be melted because it catches fire, and burns in consequence of the air getting access between its thin leaves. The fibres of the steel run in one direction, and the pens are cut in accordance with this disposition. The pens are then annealed. The preparation for forming the slit then takes place. An extremely fine edged chisel is brought down upon each separately, and is allowed to penetrate two-thirds through its substance. The edge of this instrument is finer than any razor, but is much harder, as it does not require to receive an edge during the whole of the day. This superior

quality is given to the steel by beating it for several hours with a hammer. It is an important fact, and appears to have been discovered by the pen-manufacturers. A triangular piece is next cut out at the upper end of the slit in the pen, which is called *piercing*. The next object is to give them their proper shape, which is effected by means of a punch fitting into a corresponding concavity.

The pens are then heated red hot and dipped into oil, which must be at least three feet deep. The oil in a few weeks loses its properties and becomes charred. The next operation is polishing. This is effected in a peculiar apparatus, called, emphatically, the *devil*, consisting of a fly-wheel and box, in which the pens are placed, and to which a motion is given, resembling that required in shaking together materials in a bag. This motion is continued for eight hours, when the pens are found to be completely deprived, by the friction against each other, of any asperities which might have existed on their edges, and though not visible to the naked eye, would have obstructed the free motion of the pen in writing. After this they are tempered in a box, shaken and brought to a blue colour, being carefully watched, and the heat lessened whenever a shade of yellow is observed on their surface. The split is now completed by touching its side with a pair of pincers.

With regard to the number of steel pens made, from information communicated to Dr. Faraday, it appears that Mr. Perry manufactures one hundred thousand weekly, or five million two hundred thousand per annum. Mr. Gillot employs 300 pair of hands, and consumes 40 tons of steel annually. Now, one ton of steel produces about two millions of pens. Hence, this manufacturer alone makes eighty millions of pens annually. The total quantity of steel employed in this country for making pens amounts to 120 tons, which is equivalent to about two hundred millions of pens.

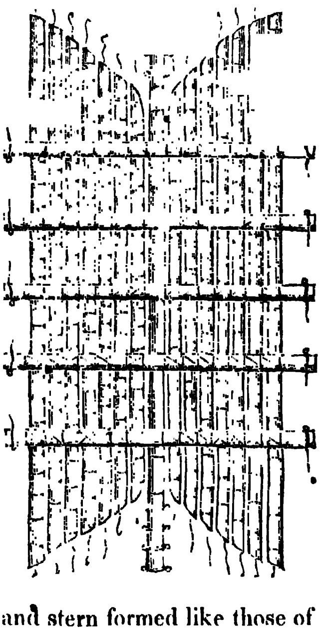
Notwithstanding the immense product of the manufacture, it is remarkable that the consumption of quills has not diminished, indeed, it is on the increase; this may be accounted for by the consideration that within the last ten or fifteen years, the population has increased one-third, and three people now can write for one at the commencement of that period; and besides, both the Continent and America are supplied by us. When first introduced, steel pens were as high as 8*s*.(?) per gross, they then fell to 4*s*., and recently have been manufactured at Birmingham at as low a price as 4*d*. the gross. It appears that the only interest that has suffered by the employment of steel pens, is that of the pen-knife makers. Pens have also been made of horn and tortoiseshell, and it is no small consolation to consider that if steel should fail us, we can have recourse to such abundant materials.*

* Thomson's Records, No. 5.

INDIA-RUBBER LIFE-BOAT.

Lieutenant Wall has communicated to the *Mechanics' Magazine*, No. 628, the following description of a Life-boat, partly constructed by him of India-rubber.

It is purposed to construct the framing of the boat of tubes of India-rubber (of any required length and diameter,) each secured by a cover of patent water-proof canvass. Having provided a sufficient number of these, in proceeding to put them together, they are to be laid flat on the ground, the longer ones outside; across which, at certain intervals, are to be laid shorter tubes of somewhat greater diameter, to which they are to be firmly lashed by thongs or other means. To each end of the transverse tubes, are to be attached thimbles and lanyards; and underneath all, fore and aft, is to be a tube longer than those at the side, fitted at each end with the necessary number of thimbles and lanyards for attaching the ends of the side-tubes. All things being thus prepared (see figure), the cross-tubes are to be bent upwards by receiving the lanyards through their opposite thimbles, and drawing them together will give the bottom of the boat a rounded form. The ends of the fore and aft tubes are then to be attached to the ends of the long centre-tube, when, by drawing all parts closely together, the ends of the vessel will be secured, and the stem and stern formed like those of a whale-boat. In order to prevent the sides of the boat from being pressed inwards, as well as to form seats for the rowers, a series of circles, formed of the same materials, are to be placed between the cross tubes, and lashed firmly to them and to each other. The whole is then to be inclosed within two covers of patent canvass ; the one outside to be finer than the other, and paid over with liquid India-rubber, to facilitate its passage through the water. Outside of all, about six inches below the gunwale, is to be placed on each side a tube of the same material, double the diameter of the others, in the centre, but tapered off to nothing at the ends, and covered with leather, which would serve as a fender on going alongside



ships in distress, and, together with bags of water for ballast, would effectually prevent the boat from being capsized. To obviate the chance of any of the tubes being wounded, and so permitting the escape of the air, it is proposed to have transverse partitions of the India-rubber placed in each of them at short intervals.

Although the system is now proposed for the construction of a life-boat only, the inventor sees no reason why it might not be adopted to almost any extent for the purposes of general navigation; nor can he at this moment say what limit could be assigned to a vessel's size, constructed of such materials. This principle might also be substituted with great benefit for the copper-tubes, which have been suggested, for giving increased buoyancy to vessels, by placing them between the timbers and beams. Such tubes as the above, in addition to their superior buoyancy and cheapness, might, in the event of distress or shipwreck, form a secure raft, or even a vessel, in which the crew and even some portion of the cargo might be saved.

In conclusion, the inventor strongly recommends that a small life-boat, constructed on these principles, be carried on board every sea-going vessel, which will be of the utmost use in many situations of danger.*

RANGER'S ARTIFICIAL STONE.

Mr. Ranger having conceived that concrete was not sufficiently understood to be duly appreciated; he therefore turned his attention to the matter, and, after considerable time expended in study and experiment, he, in 1832, took out a patent for preparing a kind of artificial stone. This artificial stone is formed in principle precisely the same as concrete, but with more care and cleanliness.

The first work executed in this new material was a wall surrounding the garden of Mr. Peel of Kemp Town. The ashlar stones (2 ft. long and 9½ in. by 8 in.) were formed on the spot, and became, in a few hours, sufficiently hard to commence setting. The mortar used in laying was formed of the same materials, and the whole became, as it were, one entire mass of concrete; having the precise appearance and the durability of Portland stone, though the proprietor did not incur above a third of the expense.

A beautiful edifice, called Belvedere Tower, was next commenced by Mr. Ranger. This building, built for the purpose of inclosing a steam-engine, is from a design from the pencil of Mr. Barry, and consists of an octagonal pedestal, upon which is placed another of a circular form, supporting eight three-quarter columns of the Corinthian order, with a very neat and elegant capital, cornice, &c. Over these are placed pilasters, or antæ,

finishing with a raised-paneled dome; and a handsome finial, constituting the chimney, completes the structure. The whole of this tower, with the exception of the octagonal pedestal, is built with this valuable material, and reflects great credit both on the architect and the builder. The tower, which answers the double purpose of engine-house and observatory, is situate on a delightful prominence in Brighton Park, the property of Thomas Attree, Esq. Two gateways to this park have also been designed by Mr. Barry, and erected of this patent stone. The southern gate is one of the most beautiful of which the county can boast.

One of the most important works undertaken by Mr. Ranger is that of undersetting the store-house in Chatham Dockyard. These foundations were laid in loose or boggy ground, by the old and dangerous method of laying pieces of timber, about 2 feet 6 inches or 3 feet square: next putting sleepers lengthwise, with the walls covered with planking, upon which the supertructure is commenced. The ultimate consequence of this imprudent method, when resorted to in a situation where the timber is subject to being alternately wet and dry, is, that, in a few years, a settlement rapidly takes place, and divides the building into numberless parts. The bond of brickwork being broken, the edifice is in a perilous state, and, unless rectified would probably fall to the ground.

The northern division of the storehouse in the dockyard at Chatham was in a most perilous state, when Mr. Ranger undertook to remove the old foundation, consisting of rotten timber in a state resembling pap, and to substitute one of concrete. The building which required undersetting is upwards of 500 feet long, and the breadth of the foundation exceeds 7 feet He commenced by digging a trench until he found a good, firm bottom; he then threw in the concrete between a framing, forming a case or box to keep the material together, and this he continued to do, till within a short distance of the brickwork. A layer of slate was then placed, upon which a machine was put, and concrete was then thrown in between this, and pressed up under the brick footing by four strong men. The instrument was made expressly for the purpose, of steel, and it answered the end excellently. The building now rests not on perishable matter, but on that which time, instead of injuring, will improve.*

UPTON'S ROTATORY LEVER ENGINE AND BOILER.

The advantages of the engine are :—1. It occupies only a seventh part of the space of the common reciprocating beam engine of equal power. 2. It has neither engine-beam, crank, connecting-rod, parallel motion, governor, air-pump, hot-water cistern, nor

* Architectural Magazine, No. 12.

any of the attendant expenses. 3. It is so constructed that, whether single or double, the steam operates upon the extremity of a lever, the fulcrum of which is the axis of the engine, as well as of the resisting force, as in the case of paddle wheels fixed at each end thereof, or of coach-wheels for locomotion on land. 4. It costs less in the first purchase, and does not require a tenth part of the expense in fixing or repairs, as compared with a beam engine. 5. It can be made to operate alternately in opposite directions, by reversing the motion of the steam. 6. It is perfectly controllable, and may be set to work or stopped instantly by any person whatsoever, if necessary. 7. It has not half the friction of common beam-engines, and, consisting of only about a dozen parts, will prove infinitely less liable to derangement, and thereby greatly increase the demand for them. 8. It can be entirely put together in the manufactory, and will require only a few days' fixing, instead of weeks, as beam-engines always occupy. 9. It is admirably adapted for team cultivation, being the best constructed engine for steam-ploughing, grist mills, and other agricultural operations. 10. It is the best application of steam-power for canal, river, and sea navigation; can be fixed to the kelson of a ship, and the axis protruded through the sides by means of perfectly secure stuffing boxes, so that the paddles may be always under water, and more out of the way of the enemy's shot. 11. It will weigh the anchor, pump the ship, and discharge and take in the cargo. 12. It requires less fuel than beam-engines of equal power, and, by occupying less space, leaves more stowage-room for goods. 13. It will be found, from its simplicity and compactness, the best application of steam-power for railways or common roads, and the most profitable engine for manufactories and mining operations. 14. It will propel a carriage at the rate of fourteen miles the hour, including stoppages for water and fuel. 15. It will not weigh,—including boiler-carriage, 16 passengers, half a ton of luggage, 75 gallons of water, and 3 sacks of coke in reserve,—more than 5 tons.

The advantages of the boiler are:—1. Its decided superiority over all other boilers yet made, consists in its being founded on the well-known principle of an air-furnace, which of all others is the best adapted for purposes of combustion, and generating the most intense heat with the least possible expense. 2. It weighs less than any other boiler yet made, generating the same quantity of steam. 3. It is safer than any other boiler, as it carries its fuel and water in separate compartments, the giving way of any one of which does not interfere with the others. 4. It is stronger than any other boiler, from the peculiarity of its construction. 5. It consumes less fuel than any other boiler yet made. 6. It works either as a high or low pressure boiler. 7. It raises steam in less time than any other boiler, and is fed from the top, but may be constructed to be fed otherwise if required.

8. It is more durable than any other boiler, and any one of the compartments for generating steam may be taken out and repaired, or replaced by duplicates, in a few hours. 9. It is the best adapted boiler for shipping ever discovered, being lighter, more compact, fed from the deck, and perfectly safe by not carrying its water in bulk; nor can any danger result, even should one of the steam chambers give way after long wear and tear; besides which, it stands on its own legs, and requires no fixing or brick work. Notwithstanding which, its heat is prevented from being acted upon by the surrounding atmosphere, and the steam is collected and preserved in one of its chambers, placed in the midst of the fire and boiling water. 10. It is the best boiler ever made, whether for stationary or locomotive purposes, on land or water.*

IMPROVED CHIMNEYS.

To construct a chimney which would carry smoke, has been found in practice one of the most precarious objects of mechanism. So little has the theory of smoke and draught been understood, that if ever a chimney was constructed to draw well, it was evidently a matter of accident; for no mechanic seemed to have any rule for constructing chimneys, which would insure a good one. We have been extremely gratified within a few days, by the inspection of a flue, and a set of fire-places, constructed upon a plan entirely new in principle, invented by Mr. Henry Antis. We had not the pleasure of seeing Mr. Antis's model; but we saw the practical effect of his discovery, by a chimney and fire-places in operation, in the house of Mr. Joseph Wallace, in Front Street; the success of which is complete, and triumphantly sustains Mr. Antis's theory on the subject. His theory is, that cold atmospheric air tends to the centre of gravity till it meets with some obstruction, which gives it another direction; that heated or magnified air is exactly vertical in motion; that hence the flue to carry it off should be perfectly vertical, and in no place of smaller dimensions than at the bottom or first inlet. He maintains that it matters not how many inlets there be to it, provided the area of a cross section of the flue be equal to those of all the inlets combined; it may be greater, but must never be smaller. He, therefore, starts with a single flue from the cellar, regulating the size, to cover the area of all the contemplated inlets from bottom to top. He carries it up, all the way of the same size, in exact perpendicular direction; nor need the wall be more than the width of one brick in thickness. Wherever he wants a fire-place, he attaches jambs of the usual shape, leaving the common perpendicular wall of the flue for a back; throwing an arch across, at the proper place, in the usual form, covering it tight to the back wall. Immediately opposite, or below the

* Inventor's Circular.

covering of the arch, he leaves a horizontal aperture in the flue, the whole width of the fire-place, from jamb to jamb, in size according to calculation previously made, and according to the height of the arch; which for jambs from twenty-four to thirty inches high, must not be less than three inches perpendicular in the opening.

There seems to be philosophy in this theory; and practice, so far as tried, proves that there is truth in it; and we have no doubt the plan will, on a little further trial, be universally adopted by builders.

Beneath each grate, fitted in a fire-place, is an opening left, which descends obliquely into the flue. In this opening, on a level with the hearth, is a fire-grate fixed, through which the ashes descend from the grate above. And such is the effect, that while a strong current of air is produced, by the heat from the fire in the grate. through the horizontal aperture above, a moderate draught is also maintained in the oblique one below, which carries off all the dust; so that from a coal fire, not a particle of dust escapes into the room. He also affixes a valve to each inlet, hung in such an ingenious manner, that the mere pulling of a small brass knob closes it entirely; and thus, in case the chimney should take fire, all the currents of air may be stopped in a moment, and the fire dies at once. Not a particle of soot can ever enter your room or your fire-place; for that, as well as the ashes, all descend to the bottom of the flue in the cellar, where an opening, with a sheet-iron door, is constructed, from which these articles can be taken; and through which a sweep may enter and perform his duties, without disturbing the business, or amusements, or quiet of any part of the family. Where necessary, he also carries up side flues in the jambs, by which air can be introduced, to regulate the temperature of your room, or the force of your draughts.

The advantages of this improvement are,

1st. Fewer materials are used, which cheapens the work.

2nd. Less room is engrossed by dead brick-work.

3rd. No annoyances from soot or ashes in your rooms—not even when a sweep ascends to clean out your flue.

4th. Power to regulate the temperature of your rooms, without opening doors or windows.

5th. Perfect security against smoke, in every room in your house.*

COOKING APPARATUS.

The Model of a Cooking Apparatus in which heat is elicited by the admission of water to some other substance, has been for some time exhibiting at the National Repository, in Leicester Square. It is a box, 1 foot on the side, and 2 feet high, composed of

* Mechanics' Magazine, No. 616.

brass plates. The interior appears to consist of three drawers: two for containing the mixture or substance from which, by the addition of water, heat is generated, and one between these two, for containing the beefsteak or other article to be cooked. Over the upper drawer is a space for water to be boiled. We saw the steak cooked, and a glass of brandy and hot water mixed. The question of the utility of this contrivance will depend almost entirely on the cost of the material employed for generating the heat, relatively to the quantity of heat produced, and its duration. Of these we have no means of judging farther than that the inventor says, that the materials, after the first cost, may be kept in order for about a guinea a year. If so, they might probably be used advantageously for heating a room without a fire-place, or a green-house. A chemical friend suggests that the substance into which the water is poured is probably sulphuric acid, which produces an intense heat; and the water can be separated from the acid by boiling. Heat might also be produced sufficiently intense to cook food by pouring water on quicklime, as is now done at the Exhibition in the Adelaide Rooms, and the carbonic acid gas and water absorbed during the process discharged by reburning. If heat and light be, as is now generally supposed by philosophers, not material substances as Dr. Black was thought to have proved, but vibrations of the nature of those which produce sound, some more elegant plan of procuring heat without fire will doubtless be sooner or later invented or discovered.*

PROPOSED SUBSTITUTE FOR STEAM POWER.

THE following is a portion of a letter addressed by Mr. Galt, the novelist, to the *Greenock Advertiser*:—

"The fatal explosion of the Earl Grey steamer has induced me to try if the principle of my pressure-syphon could be applied to propel vessels: and the result has been so perfectly satisfactory, that I find myself actuated by humanity to make it public, that others may test the experiment, the simplicity of which is not the least of its merits.

"Take a cylinder, and subjoin to the bottom of it, in communication, a pipe—fill the pipe and the cylinder with water—in the cylinder place a piston, as in that of the steam-engine—and then with a Bramah's press, and a simple, obvious contrivance, which the process will suggest, force the water up the pipe, the pressure of which will raise the piston. This is the demonstration of the first motion.

"Second—when the piston is raised, open a cock to discharge the water and the piston will descend. This is the demonstration of the second motion, and is as complete as the motion of the

* Architectural Magazine, No. 13.

piston in the cylinder of the steam-engine; and a power as effectual as steam is obtained without risk of explosion, without the cost of fuel, capable of being applied to any purpose in which steam is used, and to an immeasurable extent.

"The preservation of the water may in some cases be useful, and this may be done by a simple contrivance, viz. by making the cock discharge into a conductor, by which the water may be conveyed back at every stroke of the piston to the pipe, at the end of which the Bramah's press acts.

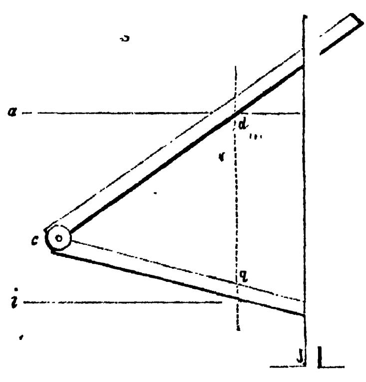
"My condition does not allow me to do more than to solicit that the experiment may be tested. Although no mechanic, I yet believe myself mechanician enough to see the application of the principle."

THE PERSPECTIVE DELINEATOR.

By Mr. Charles James Richardson, Architect.

A VERY ingenious and useful instrument has lately been invented, called the Perspective Delineator. It is the most simple and complete of any yet offered to the public, and certainly the cheapest, as the cost is only one shilling. It provides a ready and universal method of putting alike the most complicated or the most simple design into perspective; and for octangular, circular, or irregular designs of any kind, it is invaluable.

It does away with the necessity of vanishing points, and of all



lines, except those of elevation; consequently, in large views, where the vanishing points are at an inconvenient distance from the drawing-board, the principal points obtained by this instrument would save an immense deal of trouble. For the architect, therefore, as well as for the young student who has no idea of drawing perspective, this instrument is alike useful.

Mr. Shires, the inventor of it, (15, Little Chapel Street, Soho), is professor of mathematics, and tutor to the Western Institution, Leicester Square; and he teaches the use of the perspective delineator, in one lesson, the expense of which is three shillings, with an instrument included.

The method of using it is as follows. Let *p* (*see the cut*) be any point, the perspective of which is required; draw *a b*, to signify the edge of the picture; parallel to which draw the ground line *i h*; *r* is the edge of the drawing-board. Make choice of any station, say *c*, and there fix the centre of the movable angle *p c h*; now place *c p*, and also the T-square *p l*, both on the point *p*, and open the angular part *c h*, until the line *i h* comes into the angle *h*; this done, slide the T-square *l p* to the position *d q*, so that the line *a b* shall come into the angle *d*; then the point *q* so found is the perspective of *p*; and in the same manner all other points may be found, which being joined with lines, will give the perspective of any figure or solid, let its form be what it may.*

AMERICAN MANUFACTURE OF AXES.

Extract of a Letter from the New England Farmer.†

"Being lately at Douglas, Mass., I was invited by my friend, Griffin Clark, Esq., of that place, to visit the manufactory of axes, belonging to Messrs. Hunt and Co. At this establishment, about 500 axes and hatchets are manufactured in a day, of all descriptions, and of the most beautiful and perfect workmanship, and chiefly by a new mode. Besides adzes, and a variety of other species of edge tools, I noticed the Pittsburg broad axe; it is not deep, but the broadest of all I have ever seen; the edge straight, and about sixteen inches in its width; its form resembles the ship-carpenter's axe. The Kentucky axes differ from our chopping axes, only in being heavier, and having a very long bit. The chopping axes, and all of a larger size, are formed in the usual way, by doubling the iron; but all of the smaller description are formed by a new and more expeditious mode. Bars of cold iron, about an inch thick and four inches wide, more or less, according to the size of the intended axe, or hatchet, are cut into suitable lengths with ponderous shears.

"These pieces being cast into the forge and brought to the required heat, are cleft at one end, and into this cleft a tongue of cast steal is inserted; then being again heated, the complete union of the iron and steel is effected with the hammer. These being subjected anew to the fire, are laid on edge in a mould, and a single and powerful blow, or pressure of an engine, completes the profile of the small broad axe or hatchet, and this

* Architectural Magazine, No. 20.

† Quoted in the Mechanics' Magazine, No. 619.

blow being repeated a second time, renders the outline still more perfect. They are next transferred to another engine, furnished with a die: in this the axe is laid, and a heavy weight of iron, similar to those used in driving piles, being drawn up suddenly by water power, completes the form of the axe by its fall.

"Another engine is about going into use, which will give to the rough and oblong section of a bar of iron the form of a perfect and beautiful axe or hatchet at a single and instantaneous operation. Thus are these instruments formed; but the eye for the insertion of the handle is made by boring through the cold and solid iron. The axe being fixed in a firm position above, a vertical drill or species of auger perforates them from below. This auger has a three fold motion. First, a revolving motion on its own centre. Second, it moves in an orbit, which is that of a very eccentric ellipsis, corresponding with the form of the eye. Third, a vertical or upward motion at intervals; and at each time it has completed a revolution in its orbit.

"An axe is bored in about twenty minutes; and one man will attend to twenty-five augers or axes: and another man is sufficient to sharpen the drills or instruments for the same."

ZINCOGRAPHY.

Mr. S. Garner, of Lombard Street, has patented the following invention of the formation, preparation, and treatment of plates of zinc, in such a way as fits them more perfectly than has been done by methods previously employed, for the same purposes for which the slabs of stone are used, as instruments for the multiplication of copies of writings, plans, or designs, in the art of lithography. For the purposes of the art which may be called Zincography, preference is given to metal of the purest quality. The metal is to be cast in suitable moulds into plates of uniform thickness and of requisite dimensions, either of the size for use, or calculated for extension under the rollars. When it is deemed desirable, as in the generality of cases, it is considered advisable, in order to give to the metal greater density than it possesses in its simply cast form, the plates are to be subjected to the pressure of a pair of metal rollers, passing them through at a temperature at which the metal is malleable, alternately in the direction of the length and breadth of the two superficial dimensions of the plates, in order to prevent the metal from taking a fibrous texture, as it does in some degree, when repeatedly rolled in only one direction. The action of the rollers thus managed, produces a more uniform condensation of the metal than can be effected by planishing with hammer. The cast plates, whether subsequently laminated or not, are to be brought to accurate uniformity of thickness by being planed on one or both of their faces by a planing-engine, such as is now commonly used for planing the surfaces of other metals. By these

means an accurately flat working face is obtained, which conduces essentially to the more certain and uniform action of the press in the operation of working off the impressions. To render the surface of the metal better adapted to receive the marks or lines intended to be multiplied by impression therefrom, it is advisable to impart to it a certain roughness, termed, technically, a grain: this is effected by rubbing the surface to be grained with some cutting substance in a pulverulent form, such as silicious sands, emery, stone, or marble-dust, pounded pumice, rotten-stone, charcoal-powder, or other such materials, having the requisite property of abrading the metal; some such substances may be used for the purpose in masses or lumps, as pumice-stone, charcoal, &c. These materials may be employed with water, or other non-solvent liquid, being rubbed upon the metal surface in all directions, until an uniformity of grain is produced. Either two plates may be used to grind each other, or a muller may be employed, or leather, or other soft substance, may be the instrument for the application of the cutting-powder to the metal. The fineness or coarseness of the grain to be produced will of course regulate the fineness or coarseness of the grinding material to be used; but in all cases it must be guarded against applying matters of such coarseness as will cut deeply into the plate, it being the object to produce a roughness of surface of regular grain. Sometimes, perhaps, it may be useful to give a different grain to different parts of the same plate, with the view to accommodate the artist in assisting to impart a variety of character to his work; this can be done by using the grinding materials of different qualities in different parts of the plate, conducting the operation by hand, with such partial applications as may be indicated. The grinding completed, the material must be washed off, and the plate may be cleansed from impurites, to prepare it for the reception of the writing or design, by washing with a solution of alkali, either potass or soda, caustic or sub-carbonated.

The lines or traces to be multiplied from the zinc plate are made thereon by similar materials and preparations to those used for the like purposes in the art of lithography. This being done, either by hand or by transfer, they are to be fixed and prepared for the subsequent operations by brushing over the face of the plate an acidulous liquor, such as the one which may be prepared in the following manner:—Boil in a pint of water about one ounce and a quarter of bruised gall-nuts until the fluid is reduced one-third; pass the decoction when cool through a sieve or fine linen strainer, to separate the clear liquor; to which add about two fluid drachms of nitric acid, and three or four drops of muriatic acid. This formula may be varied as to the proportions of the acids, according to the nature or strength of the work to be fixed; a weaker acid for the more delicate work. The acidulous liquor may be brushed over the work with

the tool ordinarily employed for such purposes, and it may be left to act thereon, and on the metal for a longer or shorter time, according to the strength of the lines or work to be fixed, a few minutes will commonly suffice, but no injury appears to result from a longer time. The plate should then be washed with clean water to free it from the acid, and then the work may be covered with gummed water, as is done on stone. Other acidulous liquors than the one above described may be made use of for fixing the work upon the plate, such as any diluted acid, the action of which on the metal will be moderate; or solutions of many of the super-acid salts; for example, muriate, or nitro-muriate of tin; but for general purposes the patentee prefers the preparation above described, and claims to use, where convenient, or indicated for special purposes, any other form or preparation of acidulated liquor.

The zinc plates prepared and treated, in the way herein described, answer for the reception and redelivery, by impression, of all the different kinds of work now usually executed by means of stone in the art of lithography, and equalling the stone in all the properties dependant on surface; the zinc plates have the great superiority of being able to bear the action of other kinds of presses than those which have been especially adapted to the working off impressions from stone. The copper-plate roller-press, the ordinary type press, and others giving adequate pressure over the whole surface of the plate, may be employed with due effect in pulling impressions from the zinc plates.

In the processes herein described for the formation, preparation, and treatment of plates of zinc, to fit them more effectually than they have heretofore been found, for the purpose of multiplying copies by printing of lines, traces, or markings, made by certain materials upon their surfaces, consecutively used as now indicated, either to the whole extent or partially, by the omission of one or more of the processes; for instance, condensation of the metal between rollers, or modified, as by change of material, to produce certain effects, for instance, graining and fixing the lines or design upon the metal consists the invention for which the inventor has obtained the grant of the herein partially recited letters patent.*

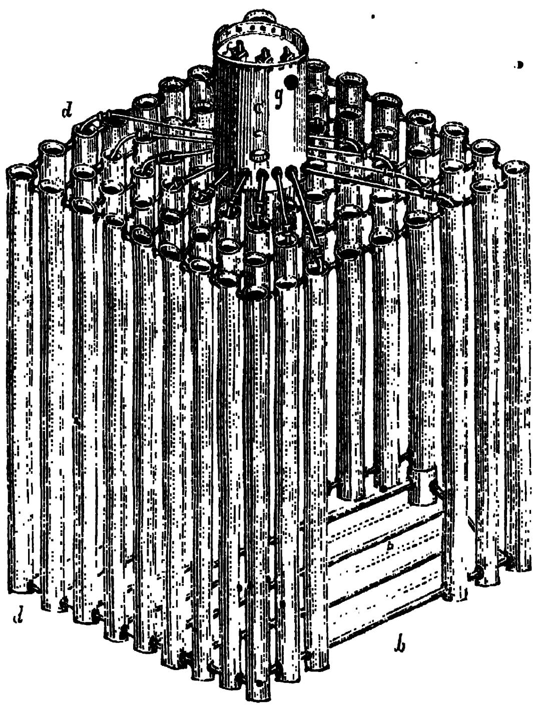
MACERONE AND SQUIRE'S STEAM-BOILER.

THE accompanying engraving represents the construction of the tubular steam-boiler recently patented by Messrs. Macerone and Squire, and used by them in their steam carriage. Looking at the boiler itself, it must be allowed to possess very considerable merit. The arrangement is simple and ingenious, and, we have no doubt, extremely efficient.

* Repertory of Patent Inventions, No. 24.

The cut shows the boiler with the outer covering off.

It consists, it will be observed, of nine rows of upright cylindrical tubes, and each row contains nine tubes, so that there are eighty-one in all. The tubes in the front row are of different lengths. The tubes in the back row are all of one length. The seven interior rows are shorter; the space thus left vacant serves for the furnace; and the space left vacant by the shortening of



the three inmost tubes of the front row, gives admission to the furnace.

The tubes are of wrought iron, of about one-eighth of an inch, with the exception of the top and bottom pieces, which are of twice the thickness.

The full length tubes, that is, those on the outside, which surround the furnace, are connected together at their inferior extremities, by horizontal tubes, of gun-metal *b*; and these horizontal tubes, with one or more solid bars placed between, serve for the furnace floor.

The whole of the vertical tubes are connected with one another,

both at top and bottom, in the manner represented in the engraving.

C is a steam-chamber or reservoir, which communicates with two cylinders of each of the vertical rows of tubes, by means of the pipes *d d*, and with the central tube of the central row, by means of the hollow projecting screw-piece *e*. This steam chamber is of wrought iron, seven-sixteenths of an inch thick, and the top and bottom are secured together by strong screw-bolts *f f f*, which pass through and through the chamber. The tubes, both vertical and horizontal, are of course kept constantly filled with water, and all the steam formed by them finds its way into the reservoir C.

The water in the vertical pipes should always be on a level with the cock *m*, and there should be nothing but steam at the height of the cock *l*. It is only necessary, therefore, to turn these cocks in order to ascertain whether there is a sufficiency of water, and to regulate the injection accordingly.

The inventors state that they generally work with a pressure of only ten atmospheres, or 150 lbs., on the square inch, but that they have pushed the pressure to as high as 70 atmospheres, or 1,050 lbs. on the square inch, without its being attended with any worse consequences than a rent in the end of one of the cylinders, through which the steam escaped into the fire, and extinguished it.

The steam is conveyed to the pistons by service pipe, placed at the back of the reservoir C, at an elevation corresponding with the letter *g*.

We subjoin an extract of a letter from Col. Macerone on the subject of this boiler, and of the steam-carriages to which it has been applied :—

"Such is the boiler with which every trip and journey has been made, spoken of in the papers, &c., and which you say Mr. Ogle asserts to be his! Ogle, in his specification, lays especial stress upon the fact, that the invention which he particularly and solely applied for, is *that a flue for the passage of the fire and heat does ascend through each of the vertical cylinders, &c. &c., so that the water, within each of them is 'between two facts.'* The only difference between the boiler as represented in my specification, and that employed in the two carriages which I have built, is, that the steam receiver is placed horizontally instead of upright, which I have found the more convenient position. * * I have succeeded in making the cylinders without rivets, by lapping and welding. * * I adhere to the plan of hollow tubes full of water for fire-bars, as that plan entirely avoids clinkers. Between each pipe there is one bar, but the vicinity of the pipes prevents them from getting so very welding hot, as when bars only are used. * * The boiler on the carriage recently running at Brussels, and now arrived in Paris, weighs 19 cwt. with its dose of water (50 gallons). The iron is one-eighth of an inch thick; that of the ends one-fourth."*

* Abridged from the Mechanics' Magazine, No. 596.

MARINE STEAM-ENGINES.

Extract from the Evidence given by JOSHUA FIELD, *Esq. of the house of Messrs.* MAUDSLEYS *and* FIELD, *before the Select Committee on Steam Navigation to India.*

You have had much experience in the manufacture of engines for steam-vessels, have you not?—Yes, I have.

What do you consider the proper measurement, and power of a steamer for a long sea-voyage?—The relative proportion of power and tonage fluctuates between two tons per horse-power and four tons per horse-power, depending upon the purposes for which the vessel is intended, as well as the length of the voyage.

What do you say as to the measurement?—By measurement, I understand tonnage. I have prepared a table which shows at one view the probable speed to be obtained by the application of engines of four different powers in vessels of the same tonnage, also the length of time for which they would be able to carry coal with each power on board. This table, if the Committee desire it, I will put in.

AN APPROXIMATE TABLE,

Showing, at one view, the Tonnage of Steam Vessels with the Power usually applied to such Vessels; the Number of Days of Twenty-four Hours' Coals they will carry, and the probable Speed they will go with smaller Powers and greater Quantity of Coal.

Tonnage of Vessel.		Days Coal.	P	Days Coal.	Power of Engines.	Da Co	Pow of Engines.	Days Coal.
252	100		80	6¼	60	8¼	40	12
290	100		80		60	10	40	15
332	120		100		80	10½	60	14
375	120	8	100	9½	80	12	60	16
425	140	9	120	10½	100	12¾	80	15¾
480	140	10	120	11½	100	14	80	16½
531	160	11	140	12½	120	14½	100	17½
597	160	12	140	13½	120	16	100	19
665	200	13	160	16	140	18½	120	21½
736	200	14	160	18½	140	20	120	23½
810	220	15	200	16½	160	20½	140	24
892	220	16	200	17½	160	22	140	26
980	240	17	220	18½	200	20½	160	25½
1,073	240	18	220	19½	200	21½	160	27
	10 mil hou		9 mil per h		8 miles per hour.		7 miles per hour.	

Will you explain to the Committee the object of this calculation; is it a comparison of tonnage with the consumption of coals and days, and the rates of going? It is to show about how many days' fuel steam-vessels will carry with larger and with smaller engines on board, as well

as the average speed to be expected from each. Such a table can only be an approximation.

Will you first state what you consider the proper measurement and power of a steamer to go a long sea voyage?—I should recommend a vessel of from 700 to 800 tons, having an engine of 180 or 200 horse-power.

How long would such a vessel run, and at what rate would she go?—She would carry coal for 14 or 15 days, and have a speed in still water of 9 or 10 miles per hour, and would realize in all weathers at sea an average of 8 miles while under weigh.

What is the greatest proportion in tonnage and power for a steamer going a long voyage?—The greatest proportion of tonnage for vessels going long voyages may be stated at 4 tons per horse-power. For short sea voyages 3 tons per horse-power; and for river vessels, as Margate or Gravesend, 2 tons per horse-power.

What results does the power give to a vessel of the same tonnage with different powers as to the rate of going?—Great power in small vessels gives great speed, but they carry a small quantity of coal and are soon exhausted, while larger vessels being able to carry a greater quantity of coals, work longer and perform greater distances.

Then you draw this inference—the longer the voyage the less the speed?—The smaller the power the greater capacity there is left for coal, and, therefore, the greater number of days' coal it would carry.

And the less speed?—And less speed having less power.

And the smaller proportion of power would of course consume less fuel in an equal time?—Exactly so.

Would not the greatest proportion of power consume the least fuel in equal distances.—Against winds or tides it is so, but in calms and fair winds it is not.

What is the greatest distance you suppose a sea-going steamer to run without changing?—The same steamer should not go more than 2,000 or 3,000 miles without a relay or time to put the machinery in order.

Does that also include without taking in coals? -A voyage of 2,000 or 3,000 miles may be performed in one stage, but it would be desirable on every account to divide it and take less coal.

What is the greatest distance she would go without coming to a station to take in fresh coals?—The distance is limited only by the quantity of coal she can carry.

What is the greatest distance you think a steamer could go without taking in fresh coals?—The greatest distance I have known a steamer to perform was the Enterprize, on her voyage to the Cape, in which she carried 37 days' coal.

With continued steaming, do you mean?—Yes: she steamed 34 days, and had three days coal left.

Do you mean steaming day and night?—Yes.

Besides the coal, is it not necessary to give the engine rest?—It is; and the more frequently they can be stopped to clean and adjust, the better they will perform.

Then your observation must be supposed to apply to both?—Yes.

What is the comparison, as to the duration between copper and iron boilers?—Copper boilers are found to last about seven years, without such repairs as render it necessary to take them out of the vessel, whilst iron boilers must be taken in four years.

Which would you prefer on the whole ?—I should prefer copper for long sea-voyages.

Is not the thickness of the metal an advantage in raising steam ?—The metal is of the same thickness, whether the boiler be of copper or iron.

The salt water does not affect copper so much as it does iron, does it ?—No, it does not.

What is your opinion of the relative advantage of the common paddle-wheel, with that of any other invention with which you are acquainted ?—The common simple paddle-wheel, when the dip does not exceed one-sixth of the diameter, is an excellent propeller, and scarcely admits of improvement ; but when vessels are so deeply loaded that the dip exceeds this in any great degree, a wheel with feathering boards will propel faster.

You have fitted river-boats with vibrating cylinders, have you not ?—Yes.

What may be considered to be their principal advantage over the other ?—The advantages of vibrating cylinders in river-boats are, that they are more simple in their construction, lighter, and occupy less space.

But in point of weight and space, what is the advantage ?—Reduction in weight is the most important consideration in river navigation.

Is not the power conveyed more immediately to the crank by the oscillating cylinder ?—The power is more durable [directly] communicated from the piston-rod to the crank : the engines are, as it were, suspended to two strong beams, which lie across the gunwale, and project for the support of the wheels, forming an independent frame, in which the strain of the engine is confined, the whole resting on the upright sides, the weight is more equally distributed over the whole vessel ; thus partial pressure on the bottom is avoided ; this admits of the vessel being of the lightest possible construction.

Is not the disadvantage, that it is very difficult to keep the connecting pipes steam-tight in the oscillating cylinders ?—As we construct that part, there is not the least difficulty.

Has not that been found to be the case ?—Speaking of those we have made, no such difficulty exists.

Must there not be continual wear, on the connecting pipes, from the motion of the oscillating cylinder ?—Not if they are properly constructed.

What is the largest power upon which you have constructed those cylinders ?—Two thirty-fives is the largest we have made upon this construction, and that was for a sea-vessel.

Would you think it advisable to make them of a larger power for sea-going steamers ?—The principle is exactly the same in this as if on the ordinary construction ; and so far as we have tried them, work just as well, and produce the same effect in speed and economy of fuel as our other engines.

What is the advantage of weight and space ?—A reduction in the weight of the engine leaves greater capacity for cargo and fuel.

What is the extent of the improvement of weight and space ?—About 10 per cent.

One-fifth of the weight and one-fifth of the space do you mean ?—No ; about one-tenth of these.

Is not the pipe in the fixed cylinder, which brings the steam, connected

with the cylinder by means of flanges, which are secured very tight together; and in the oscillating cylinder, must not the cylinder continually move on the end of the pipe, and is the chance of becoming less steam-tight greater in the oscillating cylinder than it is in the fixed cylinder?—No; the union is effected by a stuffing box packed with hemp, and is kept perfectly tight without the least difficulty.

Is it more expensive than the other?—No, they are rather cheaper.

Would they not be apt to be deranged in a heavy rolling sea?—We have not found that to be the case: one has been working in a cargo vessel, between Dover and London, during the last winter to the present time.

What is the greatest extent of time that you have had oscillating cylinders at work?—About four years and a half, or five years.

On the sea?—No, to Richmond.

That is a small high-pressure, is it not?—No, it is a low-pressure.

Have you had one on the sea for the last three years and a half?—No; only during the last year.

Was there not a second steam-boat, with an oscillating cylinder, going to Richmond?—There was one to Hammersmith last summer.

How did that succeed?—Very well, I believe.

The packet-boat from Dover to Calais makes use of an engine of that kind, does it?—Yes.

Is not the friction greater in the oscillating cylinder than it is in the fixed one?—No; as the number of bearings and moving parts are reduced, the friction should be reduced also, unless, indeed, it be badly constructed.

At what should you estimate the expense of such a vessel as you consider best calculated for a long sea-voyage?—A vessel of 800 tons, and 200 horse-power, would cost about 33,000*l.*, fitted out in the best manner, with engine and every equipment.

Then such a vessel as you stated at first, is that the one that you prefer?—Yes.

What would be the prime cost, and what the annual expense of such a vessel?—The prime cost would be about 33,000*l.*

And what the annual expense?—Do you propose to include the repairs with the expenses of working?

Working and every thing else, keeping her up and every thing?—How many days do you propose her to work in the year?

Every thing that is to keep the vessel going for as many days as she shall continue, to the end?—The annual cost of working such a vessel, including coal for steaming one-third of the time, and all other expenses, would be about 7,000*l.*

In computing the entire expense of a steam-vessel, and the annual charge, what amount should you say for capital, the sum for insurance, repairs and renewals, calculated to create the perpetuity of the property?—I think that would not be less than 25 per cent. upon the outlay.

By which means could you go the greatest distance without being obliged to take in coals; by the working a small power, and at a slow rate, or by working with a great power, at a rapid rate: for instance, an engine of 100 horse-power, working at 10 miles per hour, or an engine of 40 horse-power, working at 7 miles per hour?—In moderate weather, the small power with a great quantity of coal; but against head winds, a great power will go the greatest distance.

In the construction of a river steamer do you prefer the flat bottom with the raking bows and a parabolic curve?—I think for river steamers where the draught of water is not very limited, the form of the vessels adopted on our river to Gravesend or Margate are best for speed, they are sharp, dividing the water sideways; but, perhaps, in a very shallow river the spoon-shaped bow might be best. I do not know any experiment that would directly set that matter at rest; there are different opinions upon it.

What construction do you think the best for steering a vessel round a point against a strong current?—I should think the sharp vessel would steer better than the spoon-shaped vessel.

Would it be safe and desirable to use a high-pressure engine in a small vessel on a river, in order to lighten her draught?—I am not acquainted with any high-pressure engine that has been quite successful in a boat yet, all the high-pressure engines that I have seen are as heavy as the low-pressure engines, except in some few instances of a particular kind, which are not fit for general navigation.

How is it on the score of safety?—The low-pressure engine is of course much safer.

What do you consider to be the comparative advantage of steam navigation in seas and rivers, as to its expense and as to its certainty?—I can speak of the certainty better than the expense; the rate is increased more than double, and the time halved. I have also an abstract of sixteen voyages made between Falmouth and Corfu by sailing vessels, the mail-packets, before steam-packets were established; it is the same voyage, and the average is 93 days, the steam-packets giving an average of 47, which is half the time.

What is your opinion of the comparative advantage of the navigation in rivers and by sea in steamers as to expense and certainty?—River navigation is less expensive, inasmuch as smaller vessels will suffice, and river voyages are performed with more certainty.

Should you think a sea navigation as certain as a river navigation?—The Mediterranean packets show it to be very certain, for the fluctuation is only a very few days, which is very little for the whole four years.

On which side should you think the speed would be in favour, of the sea or the river, supposing there was a current of 3 miles in the river, and that you had 1,000 miles to go against that current, or 1,000 miles to go by sea, by which, by the river or by the sea, on an average, would you pass over in the shortest space of time?—I rather apprehend the sea.

You have given your opinion as to the proportionate power of tonnage to sea-going steamers; on what data do you found that opinion?—From having fitted out a great many vessels.

Do you mean vessels employed in the service of Government, or do you mean vessels employed for private purposes?—Both.

What number of persons, in proportion to the register or tonnage of the steam-vessel, would you allow for short voyages, and what for long?—How many it would be safe or convenient?

No; how many men would you wish to take to man your vessel, that is, the crew?—I think about one man to every 30 tons, including the stoker.

And what would be the proportion of passengers or soldiers, if you were conveying troops?—About one man to a ton, I should think, or more, for a short distance.

What quantity of fuel, and what description, do you allow per horse-power per hour?—We allow eight pounds per horse-power per hour.

What sized cylinder, and what length of stroke do you allow for 180 horse-power?—Two cylinders of 51½ inches, and 4 feet 6 stroke.

What would you allow for a 200 horse-power?—Two cylinders 53 inches diamenter, and 5 feet stroke.

What would you allow for a 250?—Two cylinders, 59 inches diameter, 5 feet 6 inches stroke.

What would you allow for a 300 horse-power?—Two cylinders, 64 inches diameter, 6 feet stroke.

What pressure do you use in the boiler?—About four pounds.

—And what in the cylinder?—As near the same as an open pipe will receive it.

And what proportion is the paddle-wheel to be to the length of the stroke?—From four to five times the length of the stroke.

What breadth of float would you recommend?—For river navigation, the wider it is the better; for sea navigation, about one-third the diameter of the wheel.

What length of time would an engine work without injury?—In one spell do you mean?

Yes?—They are frequently worked from Falmouth to Gibraltar, which is 1,100 miles, in one spell.

What is the greatest and the shortest length of time they take to do that distance; that is, a spell of 1,000 miles?—Eight is about the shortest, and 12 the longest.

How long should an engine last, if well managed, without repairs?—About from four to five years.

What parts of the engine and boilers are most liable to accident?—Those parts most exposed, such as the wheels; then the moving parts, cross heads, beams, &c.

Can duplicates of those parts be kept on board?—Yes.

Does it require any more engineers to manage an engine of 300 horse-power, than it does to manage one of 100 horse-power?—It does, but not in proportion to the increase of power.

In proportion to the power, is a large engine more economical than a small one?—Yes, it is, rather.

Does it consume less coal in the same proportion?—It consumes less coal in proportion as the power increases.

Suppose a vessel to have 300 horse-power in smooth water or a fair wind, could you work it at the same consumption of fuel which a vessel of 200 horse-power would be worked at by throttling the valves, wire-drawing the steam, or any other mode of working the engines?—Yes, you may do so.

You were speaking of the comparative advantages of river and sea navigation; would not the boilers last longer by supplying them always with fresh water?—They would, and that would be an advantage in favour of the river.

Are you aware of the improvement introduced into some steam-vessels, to condense the steam in the pipes, without admitting the jet of water into the aperture?—I am.

If this were adopted and found efficacious, you would not use the salt-water at all, neither for condensing nor for the boilers, would you?—No, I should not.

Is the salt-water more or less injurious to copper or to iron?—It is much less injurious to copper than to iron.

Is it, in comparison with fresh water?—Yes.

If that plan, which is now trying, be carried into execution, will that diminish the burthen of the engine itself in the vessel?—No, it rather increases it; but it promises to reduce the quantity of coal.

That you find to be one of the effects to arise from the improvement, do you?—Yes, I think that would follow.

It would get rid of the condenser, would it?—No, it requires a larger condenser.

You mentioned that, as applied to sea voyages, copper would last about seven years, whereas iron would last only about four years; what would be the proportion in fresh water?—In fresh water for steam navigation, the boilers last about seven years.

The iron boilers are you speaking of?—Yes; copper boilers are not used in fresh water; there is no inducement to use copper boilers in fresh water, because iron lasts so long.

Are copper boilers used in salt water?—Yes.

In preferring copper boilers to iron ones, for salt water, do you make an allowance for the difference of the tensity in copper, and the different temperature in the boiler; that copper diminishes in tensity as heat is applied, and iron does not?—We find no difference in that respect; the copper and the iron are of the same thickness, and the question turns entirely upon their durability.*

ON THE PRINCIPAL STONES USED IN THE MECHANICAL ARTS.

By Richard Knight, Esq., F.G.S.

In Part I. of Vol. L. of the *Transactions of the Society for the Encouragement of Arts*, &c., we find the following descriptive catalogue, by Mr. R. Knight, of Foster-lane, of a collection of all the principal stones used in the mechanical arts, which has been presented by him to the society. They are arranged under the two heads of arenaceous and schistose.

1. Grit or Sandstone.—Of this variety the universally known and justly celebrated Newcastle grind-stones are formed. It abounds in the coal districts of Northumberland, Durham, Yorkshire, and Derbyshire; and is selected of different degrees of density and coarseness, best suited to the various manufactures of Sheffield and Birmingham, for grinding and giving a smooth and polished surface to their different wares.

2. Is a similar description of stone, of great excellence. It is of a lighter colour, much finer, and of a very sharp nature, and at the same time not too hard. It is confined to a very small spot, of limited extent and thickness, in the immediate vicinity of Bilston, in Staffordshire, where it lies above the coal, and is now quarried entirely for the purpose of grind-stones.

3. Is a hard close variety, known by the name of carpenter's rub-stone; being used as a portable stone for sharpening tools by rubbing them on the flat stone instead of grinding. It is also much employed for the purpose of giving a smooth and uniform surface to copper-plates for the engraver.

* Abridged from Extracts in the Mechanics' Magazine.

4. Is a much softer variety of sand-stone, usually cut into a square form, from eight to twelve inches long, in which state they are used dry by shoe-makers, cork-cutters, and others, for giving a sort of coarse edge to their bladed knives, and instruments of a similar description.

5. A stone of similar properties, but of a more compact and harder description, and therefore better adapted for sharpening agricultural instruments, and may be used with or without water.

6. A porous fine-grained sand-stone, in considerable repute, from the quarries of Black Down Cliffs, near Collumpton, and well known by the name of Devonshire Batts.

7. Is a variety called Yorkshire Grit. It is not at all applied as a whet-stone, but is in considerable use as a polisher of marble, and of copper-plates for engravers.

8. Is a very similar stone, of a softer nature, and made use of by the same description of workmen, and is called Congleton Grit.

HONE SLATES.

9. Norway rag-stone. This is the coarsest variety of the hone slates. It is imported in very considerable quantities from Norway, in the form of square prisms, from nine to twelve inches long, and one to two inches diameter, gives a finer edge than the sand-stones, and is in very general use.

10. Charley Forest-stone is one of the best substitutes for the Turkey oil-stone, and much in request by joiners and others, for giving a fine edge. It has hitherto been found only on Charnwood Forest, near Mount Sorrel, in Leicestershire.

11. Ayr-stone, Scotch-stone, or snake-stone, is most in request as a polishing stone for marble and copper-plates; but the harder varieties have of late been employed as whet-stones.

12. Idwall, or Welsh oil stone, is generally harder, but in other respects differs but little as a whet-stone from the Charley Forest; but in consequence of its being more expensive, is in less general use. It is obtained from the vicinity of Llyn Idwall, in the Snowdon district of North Wales.

13. Devonshire oil-stone is an excellent variety for sharpening all kinds of thin-edged broad instruments, as plane-irons, chisels, &c., and deserves to be better known. This stone was first brought into notice by Mr. John Taylor, who met with it in the neighbourhood of Tavistock, and sent a small parcel to London for distribution; but for want of a constant and regular supply, it is entirely out of use here.

14. Cutler's green hone is of so hard and close a nature, that it is only applicable to the purposes of cutlers and instrument-makers, for giving the last edge to the lancet, and other delicate surgical instruments. It has hitherto been only found in the Snowdon mountains of North Wales.

15. German razor-hone. This is universally known throughout Europe, and generally esteemed as the best whet-stone for all kinds of the finer description of cutlery. It is obtained from the slate mountains in the neighbourhood of Ratisbon, where it occurs in the form of a yellow vein running virtually into the blue slate, sometimes not more than an inch in thickness, and varying to twelve and sometimes eighteen inches, from whence it is quarried, and then sawed into thin slabs, which are usually cemented into a similar slab of the slate, to serve as a support, and in that state sold for use. That which is obtained from the lowest part of the vein is esteemed the best, and termed old rock.

16. The same, with the hone in *natural* contact with the *slate*.

17. Is a dark slate of very uniform character; in appearance not at all laminated; is in considerable use among jewellers, clock-makers, and other workers in silver and metal, for polishing off their work, and for whose greater convenience it is cut into lengths of about six inches, and from a quarter of an inch to an inch or more wide, and packed up in small bundles from six to sixteen in each, and secured by means of withes of osier, and in that state imported for use, and called blue polishing stones.

18. Is a stone of very similar properties, but of a somewhat coarser texture and paler colours, and thence termed grey polishing-stone. Its uses are the same, and they are manufactured near Ratisbon.

19. Is a soft variety of hone-slate, the use of which is confined to curriers, and by them employed to give a fine smooth edge to their broad and straight-edged knives for dressing leather. They are always cut of a circular form, and are called Welsh clearing-stones.

20. Turkey oil-stone. This stone can hardly be considered a hone-slate, having nothing of a lamellar or schistose appearance. As a whetstone, it surpasses every other known substance, and possesses, in an eminent degree, the property of abrading the hardest steel, and is at the same time of so compact and close a nature, as to resist the pressure necessary for sharpening a graver, or other small instruments of that description. Little more is known of its natural history than that it is found in the interior of Asia Minor, and brought down to Smyrna for sale.

21. The French Burr mill-stone, so justly esteemed as the best material for forming mill-stones for grinding bread-corn, having the property of separating a larger proportion of flour from the bran than can be effected by stones formed from any other material.

22. Conway mill-stone very much resembles the French in appearance. A quarry of this was opened near Conway, about twenty years since, which at first appeared very promising; but it was soon discovered that it was the upper stratum only that possessed the porous property so essential, the lower stratum being found too close and compact to answer the purpose.

23. Cologne mill-stone. This substance is an exceedingly tenacious porous lava. Mill-stones are made of this material in great quantity near Cologne, and transported by the Rhine to most parts of Europe. Smaller stones, from eighteen inches to thirty, are much used for hand-mills in the West Indies, for grinding Indian corn, for which purpose they are well adapted.

24. Emery-stone. No substance is better known, or has been subservient to the arts for a longer period, than this. The gigantic columns, statues, and obelisks of Egypt owe their carved and polished forms and surfaces to the agency of emery. It is obtained almost entirely from the island of Naxos, where it occurs in considerable abundance, in detached irregular masses. It is reduced to the state of powder by means of rolling or stamping-mills, and afterwards by sieves and levigation.

25. Pumice-stone is a volcanic product, and is obtained principally from the Campo Bianco, one of the Lipari islands, which is entirely composed of this substance. It is extensively employed in various branches of the arts, and particularly in the state of powder, for polishing the various articles of cut glass; it is also extensively used in dressing leather, and in grinding and polishing the surface of metallic plates, &c.

26. Rotton-stone is a variety of Tripoli almost peculiar to England.

and proves a most valuable material for giving polish and lustre to a great variety of articles, as silver, the metals, glass, and even, in the hands of the lapidary, to the hardest stones. It is found in considerable quantities both in Derbyshire and South Wales.

27. Yellow Tripoli, or French Tripoli, although of a less soft and smooth nature, is better adapted to particular purposes, as that of polishing the lighter description of hard woods, such as holly, box, &c.

28. Touch-stone is a compact black basalt, or Lydian-stone, of a smooth and uniform nature, and is used principally by goldsmiths and jewellers as a ready means of determining the value of gold and silver by the touch, as it is termed—that is, by first rubbing the article under examination upon the stone, its appearance forms some criterion; and, as a further test, a drop of acid, of known strength, is let fall upon it, and its effect upon the metal denotes its value.

29. Blood-stone is a very hard, compact variety of hematite iron ore, which, when reduced to a suitable form, fixed into a handle, and well polished, forms the best description of burnisher for producing a high lustre on gilt coat-buttons, which is performed in the turning-lathe by the Birmingham manufacturers. The gold on china ware is burnished by its means. Burnishers are likewise formed of agate and flint: the former substance is preferred by bookbinders, and the latter for gilding on wood, as picture-frames, &c.*

COMMUNICATION BY EGYPT TO INDIA.

The subject of a short communication to India has been so much before the public of late, that the following tables of distances will not be unacceptable:

	Miles.		Miles.
From Bombay to Aden	1646	From Alexandria to Malta	837
Aden to Suez	1323	Suez to Quaherah	70
Bombay to Socotra	1137	Quaherah to Alexandria,	120
Socotra to Camaran	835	Suez to Boulac	80
Camaran to Cossair	795	Boulac to Alexandria	185
Cossair to Suez	270		

	Days.
Falmouth to Malta, with 2 days at Gibraltar	16
Delay at Malta	2
Malta to Alexandria	6
Alexandria to Suez	6
Suez to Aden	8½
Delay at Aden for coals	2
Aden to Bombay	10½
	51

Compare this with the route by Cossair:—

	Days.
Bombay to Aden	10½
Delay at Aden	2
Aden to Cossair	6¾
Cossair to Coptos	4
Coptos to Boulac by water	8
Boulac to Alexandria	3
	34¼

(*Wilkinson's Thebes.*)

The number of days from England to Alexandria being 24, it appears, from these computations, that the route from Alexandria to Bombay, by Suez, would occupy 27 days, while by Cossair it would require 34½ days; but if steam-boats were employed on

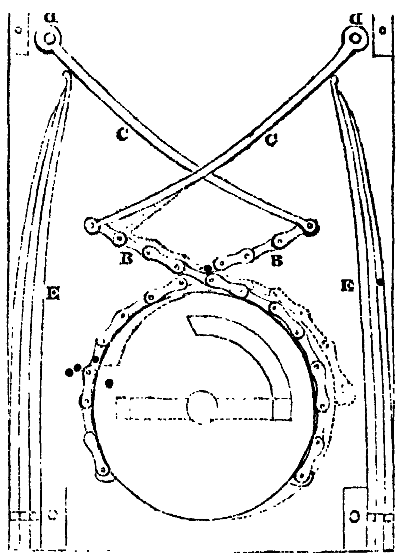
* Repertory, No. 16.

the Nile between Coptos and Alexandria, instead of the country boats as at present, the latter route might be reduced to 29 days. The line by Suez, therefore, has the advantage, even if this improvement were made. We are inclined to recommend this mode of communication as possessing advantages which neither the route by the Nile nor Euphrates possess. The latter will be attended with almost insuperable difficulties, and appears to us chimerical in the present barbarous state of the country.*

NEW SPRING FOR SHUTTING A DOOR.

This is the invention of Mr. Alexander Beattie, foreman to Mr. Robert Ritchie, ironmonger, of Edinburgh.

The spring is contained in an iron box, 11 inches by 7, and 1½ inches deep, and consists of two horizontal wheels, marked on the section A A, lying close above, and parallel to, one another, moving on the same axis with the door, to which the chains B B are attached, and moves with the wheels; the other ends of these chains are fixed to the levers C C, which move on the pivots D D, close to which the triple springs, E E, are made to press upon these levers.



When the lever or door is pressed or opened to the right hand, the under wheel is forced round, drawing back the lever C by means of the chain B, which lever the spring E presses against. There is a cog or stop F on the under wheel, which moves in a groove or slit, cut in the upper wheel, to prevent its being forced too far round.

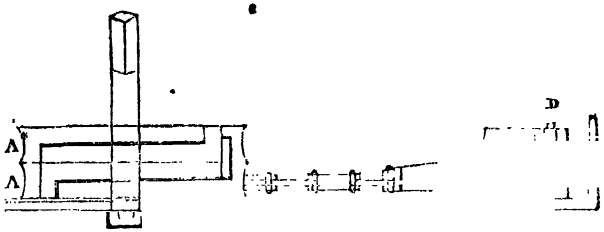
In the same manner, when the lever or door is opened to the left, the upper wheel A is forced round, until it is stopped by the cog F on the under wheel, which pulls round its chain and lever, and is pressed back again by the opposite spring E.

In this manner the wheels change the action upon the springs by the door being moved to the right or left.

The object of the inventor was to make this spring go into less

* Thomson's Records, No. 6.

room, and at less expense, than the one at present in general use. It has also the advantage of being less liable to go out of order, and can be made to turn more than the quarter circle, which the other cannot.



The box may be filled with oil, or the working points oiled occasionally, by removing part of the cover.

N.B.—By enlarging the diameter of the wheels, and strengthening the other parts in proportion, the spring can be made to suit any size or weight of doors.

Report of Committee of Society of Arts for Scotland, on Mr. Beattie's Spring Door, read 9th April, 1834.

Immediately subsequent to the meeting at which Mr. Beattie's door-spring was exhibited, it was attached to a swing door, in the premises of one of the reporters, who has paid constant attention to its action, and who, after a trial of three months, is satisfied that, to its other good qualities, it adds that of durability.

Your Committee are of opinion that the construction of this door-spring possesses several important advantages over any other they are acquainted with; and as, after a trial of sufficient duration, to have shown latent defects if it had any which had escaped their notice, they see no reason to alter the favourable opinion they had formed of it, they humbly propose that Mr. Beattie should receive some mark of the Society's approbation.*

Your Committee beg to suggest that a small alteration should be made in the form of the pieces on which the chains are wound up, which they think should be so proportioned that, as the resistance of the spring increases, the radius to which the chain applies should decrease, and in this way make the resistance of the door equal in every position, instead of, as at present, being greatest when the door is wide open.

JOHN ROBISON, *Convener.*
GEORGE ANGUS.†

* The Society's silver medal (value five sovereigns) was awarded 12th of August, 1835.

† Jameson's Journal, No. 38.

THE FREYBURG SUSPENSION-BRIDGE.

A WIRE suspension-bridge has been constructed across the Saone, at Freyburg, by M. Chaley, the celebrated French engineer, who has also erected several wire bridges in France. This bridge was commenced in 1832, but was delayed for want of funds. At length the work was once more renewed with vigour, and on the 9th of June, 1831, was extended across the valley, the first of the numerous wires which form the two main ropes or supports of the bridge. Next followed the fixing of the subordinate suspension wires, and the laying down of the beams to form the foundation or flooring of the bridge. The latter mentioned operation took place, it might be said, in a magical manner. The inhabitants were not a little surprised to find at their gates an unlooked-for, and for foot passengers a sufficiently solid bridge, where, ten days before, they had seen only two immense wire ropes. After this, the other various inferior works soon followed, as the completion of the footway, the erection of the balustrades, &c. At length, on the 8th of October, a carriage was driven over the bridge at full gallop, which was followed, on the same day, by the stage, or post-coach, from Berne to Freyburg.—Any vehicle, be it ever so heavily laden, may safely venture over; and although the ear is at first rather startled at the noise of the trampling of horses, yet the most clear-sighted person cannot discover the slightest motion communicated either to the wire-ropes or to any other part of the bridge. The traveller passing over does not feel the least vibration, and his astonishment finds no bounds, to think that he has arrived so soon, and in safety, across the deep gulf of 150 feet below.

As has been before observed, the whole structure is suspended by two large ropes of wire, firmly secured at each end, by being let into shafts made for that purpose. At each end the porticos, over which the ropes pass, serve for antagonist supporters, or counterforts. They are built partly of limestone, brought from Neuenberg and Neuenstadt, and partly of sand-stone, which is got in the stone quarries in the neighbourhood of Freyburg: all the blocks are, by way of greater security, connected with each other by means of iron cramps. The quantity of iron used for this purpose was 570 cwt. The height of the porticos is 65 Berne feet. The opening for the gateway is 45 feet high, 20 feet wide, and 19 feet in depth; the width of each pillar is 14 feet. About 160 feet from the porticos the shafts are situated; their depths are each 58 feet, and their diameters 32 feet. These shafts are hewn out of the rock on both sides, and comprise each three chambers, situated at a certain distance from each other, each containing three immense unwrought blocks of Neuenberg stone, to which the main wire ropes are fastened. The connecting wires or chains, 16 in number, are drawn through these vaults; they rest at the same time on 12 cast iron

cylinders, and are held fast by 128 anchors or grapples, of a total weight of 4,024 lbs. These connecting ropes or ties serve the great main wire ropes as auxiliary supports, which bear up on both sides the great beams of the bridge-flooring, by means of suspension wires or ties. The length of the main wire ropes is 1,280 feet each. They consist each of 2,000 separate wire threads, which united make a mass of 4,000 threads, or little chains, of a total weight of 960 cwt. Dependent from each of the two main connecting wire ropes, or inverted arch, hang 164 smaller suspension wire ropes, at about 5 feet asunder: these are made fast above through iron loops, and below are connected with hoops of iron, into which the beam ends which support the footway are firmly fastened. The longest of the smaller dependent ropes of wire is 60 feet, and the shortest half a foot: each is composed of 25 single wires, so that the roadway of the bridge is held up by more than 8,000 single wires. The number of beams which form the foundation or platform of the bridge, amounts to 166, held together by 328 hoops of wrought iron. Four lines of beams run longitudinally throughout the whole length of the bridge, upon which rest the two footways. On both sides, to separate the carriage-way from the footpaths, are strong oaken balustrades, made in the form of St. Andrew's cross, the height of which is four feet. The carriage-way is 16 feet, and each footway 3 feet, wide; so that the total width of the bridge is 22 feet. Its total length, including the two counterforts, over which the main wire ropes are passed, is 941 feet; exclusive of the counterforts, its length is 903 feet; the carriage-way alone is 864 feet. Its height above the river, when measured 30th Oct. 1834, was 163 feet.

The quantity of iron used in this work was not less than 80 tons, and of wood 135 tons.

The weight sustained by the two main wire stays is 120 tons, and it is calculated to sustain the amazing and enormous weight of 2,400 tons.*

EXPANSIBILITY OF DIFFERENT KINDS OF STONE.

By Mr. Alexander J. Adie, Civil Engineer.†

THIS paper contains the results of an extensive series of experiments made upon different kinds of stone, as well as upon iron and upon brick, porcelain, and other artificial substances. The instrument employed was a pyrometer, of a simple construction, capable of determining quantities not greater than $\frac{1}{30,000}$ of an inch. The length of the substances generally employed was 23 inches. The general result of these experiments is, that the

* Abridged from the German account, translated in the Mechanics' Magazine.

† Communicated to the Royal Society of Edinburgh, April 20.

ordinary building materials of stone expand but very little differently from cast iron, and that, consequently, the mixture of those materials in edifices is not injurious to their durability. The experiments from which the expansibility of the substances was numerically determined, were made between the limits of ordinary atmospheric temperature and that of 212°; steam being introduced for that purpose between the double casing of the instrument.

The following results were obtained for the fractional expansion of the length, for a change of temperature of 180° Fahr.:—

Table of the Expansion of Stone, &c.

	Decimal of length for 180° Fahr.
1. Roman Cement,	.0014349
2. Sicilian White Marble,	.00110411
3. Carrara Marble,	.0006539
4. Sandstone from the Liver Rock of Craigleith Quarry,	.0011743
5. Cast Iron from a rod cut from a bar cast 2 in. square,	.00114676
6. Cast Iron from a rod cast half an inch square,	.001102166
7. Slate from Penrhyn Quarry, Wales,	.0010376
8. Peterhead Red Granite,	.0008968
9. Arbroath Pavement,	.0008985
10. Caithness Pavement,	.0008947
11. Greenstone from Ratho,	.0008089
12. Aberdeen Grey Granite,	.00078943
13. Best Stock Brick,	.0005502
14. Fire Brick,	.0004928
15. Stalk of a Dutch Tobacco pipe,	.0004573
16. Round rod of Wedgewood Ware (11 inches long),	.00045294
17. Black Marble from Galway, Ireland,	.00044519

NEW BALL PROJECTOR.

A French agriculturist of the name of Billot, who has assiduously cultivated the mechanical arts, has invented a machine which will discharge 2,000 balls, each 8 ounces in weight, per minute, or 120,000 in an hour, and this without the slightest intermission. The action of this formidable machine may be arrested or continued at will; the balls are discharged from four different muzzles, which may be directed upon objects at a less or greater distance from each other, or they may be brought to bear simultaneously on one and the same point. Billot's machine, however, is not capable of carrying such balls a greater distance than 100 metres (about 110 yards); but he asserts that he can improve it, so as to impel the same balls a distance of 450 yards, and with a velocity scarcely inferior to that imparted by gunpowder. In this case, he adds, that he shall be obliged to increase its weight from 80 to 310 lbs. He does not employ either air, spring, or combustible matter in this new projectile; and his name is of some note among French mechanics as the

inventor of two new levers, which are to be seen in the collection of the Societé d'Encouragement at Paris.*

COTTON MANUFACTURE.

In January, Mr. Aikin read to the Society of Arts a paper on the natural history and commercial history of cotton.—The word *cotton*, observed the lecturer, has been adopted in modern European languages from the Arabic word, meaning the same thing, and which, when put into English letters, would be pronounced *kutun*: in Egypt it is called *gotun*. The Spanish word *algodon* is evidently the Egypto-Arabic word, with the article *al* prefixed. The Germans, who in general avoid intercalating into their language words of foreign origin, call it *Baumwolle*, *i. e.* tree-wool. Mr. Aikin then laid before his numerous auditors the most important notices which are to be found in ancient classical authors, respecting the growth of cotton in India and on the coast of Arabia; and the importation of cotton fabrics of various qualities from India to Egypt by the way of the Red Sea. He likewise noticed the establishment of the culture of the cotton plant on the coasts of the Mediterranean—but, though exceedingly interesting, our space calls upon us to pass on to more modern times. Cotton wool was imported by the Genoese and Venetians into England and the Netherlands in the very beginning of the fourteenth century; but the use to which it was applied, except for candlewicks, is not known. In 1430, fustians were made, perhaps invented, in Flanders—being probably intended as an imitation of the velvets manufactured in Italy. In 1534, several ships from London and Bristol traded to the Levant, and imported, among other articles, cotton wool. It might be expected, therefore, that at this time some cotton fabrics would have been established in England; and this seems at first sight to be confirmed by a statement in Leland's *Itinerary*, in the reign of Henry the Eighth, that cottons were made at Bolton-le-Moors in Lancashire, and in the villages about; as also by the mention in an act of parliament, passed in 1552 (Edward VI.), of Manchester, Lancashire, and Cheshire cottons. In this manner Mr. Aikin came down to the present period; noticing, however, as he went along, the invention of the "spinning jenny" in 1767. This engine draws several threads at once; and as it derives it principal motion from a mechanical first mover, produces them more even than had heretofore been done by hand. It was soon discovered that an improved method of carding the cotton, before it was subjected to the action of the jenny, was essential to the good performance of the machine. This was attempted with some success by Mr. Hargreaves, was very much improved on by Mr. Peel, and was brought to perfection in the carding machine of Mr. Arkwright. Egyptian

* United Service Journal.

cotton was introduced in 1823; it is of a long, strong, and silky staple, and has since been improved by the introduction of seeds of the Sea Islands' cotton. The demand for raw cotton in the British market has gone on progressively increasing; the following are the details of the importation of cotton wool for the last year, viz.—

Uplands and New Orleans	262,885,000 lbs.
Sea Islands	3,500,000
Brazil	26,540,000
Surat and Bengal	11,570,000
West Indies	1,610,000
Egypt	1,540,000
	303,645,000 lbs.

On comparing the above with the importation of 1831, it appears that there is an increase in the last year in the proportion of 303 to 288: but that the quantity furnished from all the above-mentioned countries, except the United States, has diminished. In the year 1832 the whole quantity of cotton spun in Great Britain was 277,260,000lbs., of which about one-ninth, or 30,325,000lbs., was loss from dirt and waste in spinning, and the produce was 216,935,000lbs. of yarn. Of this quantity 222,596,000lbs. was spun in England, and was thus disposed of: —Exported in yarn 71,662,000lbs.; ditto in thread 1,041,000lbs. manufactured goods 61,251,000lbs.; or about 134 millions of pounds. Besides the above, there were candlewicks and mixed goods, of which, part were exported, 12,000,000lbs.; supply of home market and stock on hand 70,941,000lbs.; sent to Scotland and Ireland 5,700,000lbs.: total 88,641,000lbs. Therefore, in whole numbers, about 62 per cent of the entire quantities of cotton manufactured in England is exported; and of this 33 per cent. is in the state of yarn and thread, and 28 per cent. in woven goods. According to Mac Culloch, the total value of every kind of cotton goods annually manufactured in Great Britain at present may be estimated at 34,000,000*l*; from which if we deduct 7,000,000*l*. as the cost of the raw material, and 21,000,000*l*. as wages to 900,000 workmen, there will remain for the cost of superintendance, coals, materials of machinery, and profit, 6,000,000*l*. The amount of capitalvested in buildings and machinery is computed at 20,000,000*l*. *

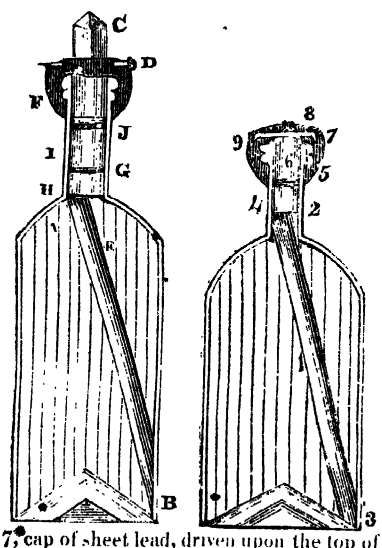
NON-PERMEABILITY OF GLASS BY WATER.

The following experiments were made in the North and South Atlantic and Indian oceans, by Mr. Ridder, late of Birmingham, during his passage to New South Wales, with the view of ascertaining whether water passed through the pores of glass bottles, sunk at different depths in the ocean. The result of the experiment with the bottle, No. 4, prepared after the manner described

* Literary Gazette, No. 939.

in the annexed diagram, and sunk 150 fathoms, clearly proves the non-permeability of glass, a fact which is corroborated by a series of experiments subsequently made by Mr. Wickenden, and described, by that gentleman, in a very lucid manner, on reading the Paper—of which the following is an abstract—before the members of the Birmingham Philosophical Institution.

No. 1. No. 4.



No. 1.

E, Piece of wood supporting the cork H at A, and resting against the inside of the bottle at B.—H, cork.—G, sawdust and pitch.—I, wine.—J, canvass passing up the neck of the bottle to the outside, and covered with boiling pitch.—C, wooden plug, driven in with melted pitch upon the body J.—D, iron nail passed through the plug, C, over which a piece of canvass was passed, and that with the canvass at J, pitched over and firmly secured to the neck of the bottle with string, likewise pitched over, as at F.

No. 4.

1, Piece of wood supporting the cork, 4, at 2, and resting upon the bottom of the bottle at 3.—5, layer of melted pitch. 6, cork driven in with melted pitch, and afterwards covered over with a thick layer of pitch. 7, cap of sheet lead, driven upon the top of the cork and pitch, 6, and bound down with copper wire and string at 8.—9, outside coating of pitch, extending from the rim of the lead, covering over the neck of the bottle.

A wine-bottle was prepared as described in the annexed diagram, No. 1; another was likewise thus secured:—a piece of wood was placed in the bottle to support a cork, over which was inserted sawdust and melted pitch; a wooden plug, dipped in hot pitch, was driven in, and through the top of the plug a nail was passed transversely, secured with twine; the whole was then coated over with melted pitch. Mr. Benson, the surgeon of the ship, *Princess Victoria*, also prepared a bottle as follows:—a cork was tightly driven in and covered over with bladder and leather, after which it was pitched and a wooden cap placed closely over the mouth and neck, secured with a piece of canvass. The three bottles were then sunk to the depth of 58 fathoms; when hauled up, the bottle No. 1, contained about an ounce of water; the other two bottles were perfectly free from any liquid. The bottles were again lowered in 83 fathoms without any addition to the water, and a third time in 112 fathoms; when, on being carefully examined, No. 1 was found one-fourth full, and the water discoloured with the wine; the second bottle contained about an ounce of water: Mr. Benson's was, also, two-thirds full, with the cork driven in and floating on the surface,

and the water much agitated, having the appearance of champagne when the cork is first drawn, the air producing a loud hissing in its effort to escape. In making this experiment the lines were impelled towards the west, by a strong current setting in from the east, which rendered it necessary to back the boat to the west, with considerable rapidity, in order to sink the lines perpendicularly. On the bottles being lowered a fourth time to the same depth, viz., 112 fathoms, Mr. Benson's bottle, when brought up, was quite full of water, and the cork replaced in its original position; the water in bottle No. 2 was not increased, but the nail, passed through the plug, was very considerably bent inward, and the top of the cork and pitch brought nearly on a level with the glass. The bottle No. 1 had received an additional quantity of water, making it one-third full, but there was no perceptible change in the outer coverings.

Another experiment was subsequently made by sinking a bottle, prepared as described in figure 4, in the subjoined diagram, to the depth of 142 fathoms, sustaining a pressure of about 426 pounds on the inch. When drawn up, it was found that no water had penetrated the bottle, and the only perceptible alteration was an indentation of about one-fourth of an inch in the lead, produced by the excessive pressure.

Two other bottles were prepared in a similar manner, with the exception of the lead caps, and were sunk to a depth of 102 fathoms. These bottles were filled with water, and the corks which, previous to immersion, stood nearly half an inch above the necks of the bottles, had been so much compressed as to allow the water to pass round them. One of the corks exhibited this compressed appearance for a length of time after it was drawn up, leaving the pitch standing like a wall above the neck of the bottle.

The next experiment was made in the jolly boat, at some distance from the ship, as on former occasions; when three bottles were sunk to the depth of 150 fathoms, and, consequently, subjected to a pressure of about 450 pounds on the square inch. When drawn up, it was discovered that Mr. Benson's bottle was full of water, and Mr. Rudder's perfectly free from all fluid. The bottle sunk by Mr. Benson was prepared by placing a wooden stay within the bottle, as shown in figure 4, upon which a cork was firmly driven.* The neck of the bottle was then filled with melted pitch, into which a cork was forced down; over the whole was tied a piece of leather, and the neck of the bottle immersed in pitch. Mr. Rudder's first bottle was prepared in a similar manner to Mr. Benson's, excepting that the cork was cut off flush with the neck of the bottle (which, being patent, was consequently true), and, after being dipped in boiling pitch, a halfpenny was imbedded upon the top of the cork. The second bottle had the wooden stay for support to the cork, fixed perpendicularly; and over the above-described stopping a cap of lead, of about one-eighth of an inch in thickness, was secured, and pitched over, excepting on the upper surface of the lead. The appearance of the respective bottles, when drawn up, was as follows: Mr. Benson's bottle had the corks and their covering so compressed that they were nearly three quarters of an inch below the rim of the neck, and the bottle as full of water as bottles usually are of wine. The air in the neck of the bottle, which must have been highly compressed, continued to issue through the pores of the cork for a considerable time after the bottle had been drawn up. In Mr. Rudder's first bottle no alteration was apparent; and in the second the only change that had

taken place was the compression of the lead inwards, forming a concavity, of about one-fourth of an inch in depth, in the centre.

As the experiments made by Mr. Rudder and Mr Benson were considered inconclusive, in relation to the question of the porosity of glass, or its permeability by water, (the pressure of a column of water of 900 feet, the depth to which their bottles were plunged, not exceeding a pressure of 450 pounds on the square inch). Mr. Wickenden, with the assistance of an intelligent member of the Institution, proceeded to make the following experiments:—Glass balls, varying in size and thickness, were hermetically sealed, and subjected to a pressure of 1,050 pounds on the inch; that is equivalent to the weight of a column of water of about 2,000 feet, or 350 fathoms, exceeding the pressure to which the bottles were exposed by 200 fathoms. The integrity of the globes was maintained in this experiment, and not a drop of water entered. In order to submit the globes to the greatest accessible pressure, it was determined to place them in the plunger of Bramah's hydraulic press. The balls, which were three inches in diameter, were inclosed in a box, perforated to admit the water, and after being subjected to a superficial pressure of between eighteen and nineteen tons, or about a ton and a half on the square inch, (which is equal to a column of water of 1,120 fathoms, or 6,720 feet, that is, a weight of 3,360 pounds on the square inch) they were taken out uninjured, and perfectly free from internal moisture.

From the whole of the foregoing experiments, the following conclusions may be drawn. 1st. It appears extremely difficult, by stopping the mouths of bottles with extraneous matters, such as cork, wood, pitch, &c.. to resist the stupendous weight of columns of water of great altitude.

2ndly. That at a depth of 150 fathoms, or 900 feet,—that is, with a pressure of about 150lbs. on the square inch, glass is *not* permeable by water.

By the experiments made with glass balls, the difficulties of stoping are overcome, whilst a form is employed better adapted to resist the higher degrees of pressure; and the presumptive evidence of the non-porosity of glass, or rather impermeability by water, is greatly increased.

The question assumed as proved by Mr. Rudder's experiments, is the non-porosity of glass. The transmission of light and magnetic influence through this substance might, perhaps, be considered as sufficient evidence of such structure. A more accurate statement of the object of these experiments, therefore, would be to prove the impermeability of glass by water under high degrees of pressure.—Were it possible for glass balls to resist the sudden expansion and heat of steam, the proof required would be more probably attained by the tenuity of the elastic vapour of water, than by the same fluid under the most severe pressure.

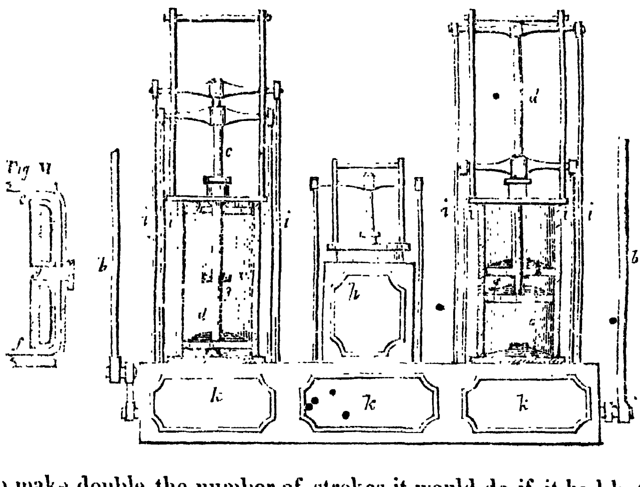
In one of Mr. Rudder's experiments, it was observed that the cork had been forced into the bottle, and was seen floating on the surface of the water which half filled the bottle, and upon replunging the bottle to the same depth, 112 fathoms, the vessel filled and the cork was replaced. The replacement of the cork

as originally inserted, or reversed, so far as position is concerned, is purely accidental; when the cork, by equal pressure, has been so far reduced in all its dimensions that either end of it would enter into the neck of the bottle, that part would be certain to be uppermost, which presented itself to the neck, during the ascent of the bottle.*

NOBLE'S STEAM-ENGINE.

Mr. W. A. Noble, of Bermondsey, has patented the following improvements in applying steam to the common and other engines.

Mr. Noble's improved steam-engine consists in having two pistons in one cylinder, by which means the engine is enabled



to make double the number of strokes it would do if it had but one piston, consequently double the velocity (or power) is obtained without the aid of multiplying wheels.

The above drawing is a representation of a perpendicular section of the cylinders for a pair of thirty-horse marine engines. *a*, the cylinder. *b*, *b*, the pistons. *c*, the hollow piston-rod, with a stuffing-box at the end, which admits of the piston-rod to the lower piston passing through. *d*, the solid piston-rod to lower piston. *e*, the steam-port which admits the steam to act on the upper side of the upper piston, *b*. *f*, the steam-port which admits the steam to act on the underside of the under piston. *g*, the steam-port which admits the steam in the centre of the cylinder to enable it to act on the two pistons. *h*, the cistern which contains the air-pump and the condenser. *i*, *i*, *i*, *i*, the connecting-rods to the crank, *k*,

* Analyst, No. 13.

by which the power of the two engines are united. *k*, the four-throw crank, shown by the dotted lines running under the base of the cylinders and condensers. *m*, represents the steam-ports above specified, as seen from the other side of the cylinders, and the steam is let on and off in the usual way. *l*, *l*, the connecting-rods from the crank of the engine to the crank of the paddle-wheels. The steam being admitted through the steam-ports, *e* and *f*, forces the pistons, *b*, *b*, together, the steam is then turned off into the condenser in the usual way, which is unnecessary to describe, at the same time the steam is admitted by the steam-port, *g*, between the pistons, the one is then forced up and the other down: the above action is then repeated, which being connected to the cranks by means of the connecting-rods, *i*, *i*, *i*, *i*, the machine or paddle-wheels is set in motion.

The patentee does not confine himself to the operation of two pistons in one cylinder, as more might be employed: but two appear to be sufficient. The same principle of two or more pistons in one cylinder is applicable to engines of high-pressure principle.—In witness whereof, &c.*

ECONOMIC APPLICATION OF ELECTRO-MAGNETIC FORCES TO MANUFACTURING PURPOSES.

By Robert Mallett.

THE separation of iron from brass and copper filings, &c., in workshops, for the purpose of the refusion of them into brass, is commonly effected by tedious manual labour. Several bar or horse shoe magnets are fixed in a wooden handle, and are thrust, in various directions, through a dish or other vessel containing the brass and iron turnings, &c., and when the magnets have become loaded with iron, it is swept off from them by frequent strokes of a brush. This is an exceedingly troublesome and inefficacious process.

It appeared to the author that a temporary magnet of great power, formed by the circulation of an electric current round a bar of iron, might be substituted advantageously. The following is the arrangement which he has adopted. Several large, round bars of iron are bent into the form of the capital letter U, each leg being about six inches long. They are all coated with coils of silk-covered wire, in the usual way of forming electro-magnets of such bars, and are then arranged vertically, at the interval of five or six inches from each other.

All the wires from these coils are collected into one bundle at their respective poles, and there joined into one by soldering, a large wire being placed in the midst of them and amalgamated. A galvanic battery is provided, which, if care be taken in making the junctions at the poles, &c., need not exceed four, or, at most six pairs of plates, of from twenty inches to two feet square. The poles of this terminate in cups of mercury, which are so

* Repertory of Patent Inventions, No. 20.

placed that the large terminal wires of all the coils can be dipped into them, or withdrawn easily.

The rest of the arrangement is purely mechanical. The required motions are taken from any first mover, usually a steam engine. The previously described arrangement being complete, a chain of buckets is so contrived as to carry up and discharge over the top of the magnets a quantity of the mixed metallic particles: most of the iron adheres to the magnets, while the so far purified brass falls into a dish or tray placed beneath to receive it. This latter is also one of a chain of dishes, the horizontal motion of which is so regulated that the interval between two dishes is immediately under the magnets, in the interval of time between two successive discharges of the mixed particles on the bars.

At this juncture the communication between the galvanic battery and the magnets is interrupted by withdrawing the wires from the cups of mercury, and the result is, that the greatest part of the adhering iron drops off and falls in the space between the two dishes. The next dish now comes under the magnets, the communication is restored, and a fresh discharge from the buckets takes place, and so the process is continued.

Some iron constantly adheres to the magnets, but this is found of no inconvenience, as it bears but a small proportion to the total quantity separated.

The author has had an imperfect apparatus of the sort above described at work for some time, and has found it to answer; and suggests the application of electro-magnets for somewhat as analogous objects in various manufactures. He particularly mentions needle and other dry grinding.*

HALL'S IMPROVEMENTS IN STEAM ENGINES.

Mr. Samuel Hall, of Basford, Notts, has patented certain important improvements, which he thus describes in the specification.

The object of my invention, (which invention I confine to steam engines worked by a vacuum produced by condensation,) are to condense without injection-water (for the purpose of creating as good a vacuum as is obtained and well known in injection-engines), the steam which passes through the engine for the working thereof, and also to condense for the most part (if not wholly) that portion of steam which usually escapes into the atmosphere through the safety-valves, when the pressure of the steam in the boiler is too high during the working of the engine, in order that the water resulting from the condensation of such steam, may be returned into the boiler. And also, further, to supply so much more distilled water to the boilers of the above

* Proceedings of the British Association, in the Philosophical Magazine, No. 40.

mentioned description of engines, as is required to supply and replace any waste that may take place in the working thereof, in order to avoid the introduction of any water (into the boilers) containing saline or other extraneous matters.

My invention does not consist in the novelty of any one of the five apparatus hereinafter mentioned, but in the combination of the whole five, or at least three out of the five, within proper proportions (as hereinafter described) as regards the first three, which I have found, by experience, to be beneficial, and from the want of knowing and observing which, I have reason to believe that all persons who have made former attempts of the same nature have failed. I now proceed to describe the above mentioned five aparatus, consisting of—

First, a sufficient quantity of metallic surfaces in the form of vessels, channels, passages, or pipes, of any convenient form, arrangement, or construction, wholly open to and being pervaded by steam on its exit from the steam-cylinder of the engine, the water resulting from the condensation thereof coming in contact with the metallic surfaces and making its immediate escape without being detained in the pipes, as was effected by my invention, for which I obtained a patent, dated December 22, 1831. The extent of such metallic surfaces should be about 2,800 square inches for the condensation of each 60,000 cubic inches of steam per minute, when it is of the pressure of four pounds upon the square inch, above the pressure of the atmosphere. I use fifty thin copper pipes, half an inch internal diameter and three feet long each, for the condensation of the above mentioned quantity of steam at the aforesaid pressure, which quantity of steam per minute I consider as productive of one horse power.

Secondly, a pump, or any other proper apparatus, for the passing of a sufficient quantity of cold water amongst such above mentioned pipes, not only to condense all the steam of steam-engines, but also to cool the water resulting from the condensation thereof to as low a temperature as (or even lower than) that of the mixture of the condensed steam and injection-water, which is discharged from the air-pumps of injection-engines, in order to produce, by such application of cold water, when used in combination with the metallic surfaces, as above stated, and with the air-pump hereinafter mentioned, as good a vacuum as is obtained and well known in such injection-engines, if not indeed a still more perfect vacuum. The quantity of cold water which I employ is ten gallons for such condensation of such 60,000 cubic inches per minute.

Thirdly, the ordinary air-pump, of the capacity hereafter stated, to produce, when in connexion with the before mentioned two apparatus, a sufficiently perfect vacuum, as above defined, by carrying away not only the water resulting from the condensation of the steam, and any air that may enter into the con-

denser through bad joints or otherwise, but also the vapour arising from the water resulting from the condensation of the steam, such vapour being more or less dense, according as the water is of a more or less elevated temperature, as is shown by the experiments and tables of Mr. Dalton, and other scientific men. Such air-pump, if a single acting-pump, should be of such a diameter that its area shall not be less than one-eighth of the area of the steam-cylinder, the piston making (as is usual in most engines) a stroke half the length of that of the piston of the steam-cylinder, and both pistons making the same number of strokes per minute; the above capacity I state as the minimum at which the pump should be applied, but the capacity may with advantage be considerably increased: I use it of half of the area of the steam-cylinder, under the above mentioned circumstances, and it may be increased even beyond that capacity.

Fourthly, an apparatus for distilling water to replace the waste of water that may take place in the working of the engine, in order to avoid, as above mentioned, the introduction of any water into the boilers containing saline or other extraneous matters.

Fifthly, an apparatus (which I call the steam-saver) for saving the steam that usually escapes into the atmosphere from the safety-valves when it becomes of too high pressure during the working of the engine, the apparatus causing such steam to pass into the condenser to be converted into water and returned to the boiler. It may be proper here to remark, that, within certain limits, which experience will readily suggest, the above mentioned proportions of metallic surfaces of cold water and capacity of the air-pump may be varied in a certain inverse order, that is to say, if the cold water be diminished, the extent of metallic surfaces, or the capacity of the air-pump, or both, should be increased. And, on the other hand, if the extent of metallic surfaces be diminished, the quantity of cold water, or the capacity of the air-pump, or both, should be increased to produce the same effect.*

NEW ROTATIVE STEAM-ENGINE OF INCREASED POWER CONSTRUCTED BY MR. SIMS.

By John Taylor, Esq. F. R. S., Treas. G. S., &c.

It is very well known to those who have observed the duty of steam-engines employed in the mines of Cornwall, that an enormous difference has existed between those which raise water by a reciprocating motion, and those which for other purposes have that motion converted into a rotative one by the intervention of a crank. The cause of this difference has often been speculated upon, but has not, I believe, been well explained:

* For the illustrative Drawings, See No. 14 of the Repertory.

it is important in an economical point of view, as while in the pumping engines sixty millions pounds are commonly raised one foot by each bushel of coal consumed, the rotative engines for stamping ores have seldom raised more than twenty millions, and those for winding up the ores from under ground are found to be even far below this in effect.

Now, it should be observed, that the pumping engines are at present universally, I believe, single engines, that is to say, receiving the steam from the boiler on one side of the piston only, the principle of working double, as it is called, which was introduced by Mr. Watt, having been for some time descarded; and in these single engines the method of working high pressure steam expansively, which we owe to Mr. Woolf, has long been used with the greatest advantage.

The rotative engines in Cornwall, like all others which are used for manufacturing purposes, are double engines, and receive the steam alternately above and below the piston; and though attempts have been made to work them expansively, these attempts have not been very successful.

The object of my present address to you, is to notice an engine which has lately been constructed for a mine in which I am interested, which is a rotative one for stamping tin ores, and which, when I visited the mine a few days since, was calculated to be performing a duty of about sixty millions, or nearly equal to the average of the better class of reciprocating engines, and nearly three times as much as the best rotative engines have hitherto done.

I wish to call the attention of persons concerned in the use of steam engines to this fact, because if it should be found that this rate of duty can be maintained, a very great improvement may take place in all such as are most generally employed.

This engine is at work at the Charles Town united mines, near St. Austle; it was erected for us under the direction of Mr. Sims, an engineer of great experience in Cornwall. It differs from the general construction, in being a single engine, having the beam loaded at the outer end; and the rotatory motion of the crank is rendered almost completely uniform by the assistance of the fly-wheels. It works nearly as expansively as the pumping-engines.

It was predicted, I understand, before the engine went to work, that a steady rotative motion could not be produced in this way, and some believed that the crank would never pass the centre; I can, however, bear witness that the action is extremely good, and will, I believe, by a little alteration in the weight and diameter of the fly-wheels, be made perfect; and as it must be an object to save at least one-half the fuel ordinarily consumed, I point it out as deserving attention and inquiry. I have desired that its performance may be regularly reported in the monthly duty papers.

I am informed by Captain Thomas Lean, who reports the duty of most of the engines in Cornwall, that this is not the first construction of the kind, but that a similar one was erected formerly at Wheal-Vor tin-mine, by Mr. Peter Godfrey, and that it then surpassed in duty any other stamping engine of its day, but that for some reason it never attracted much notice.

Mr. Sims is constructing a winding engine for the same mine, on a similar principle.*

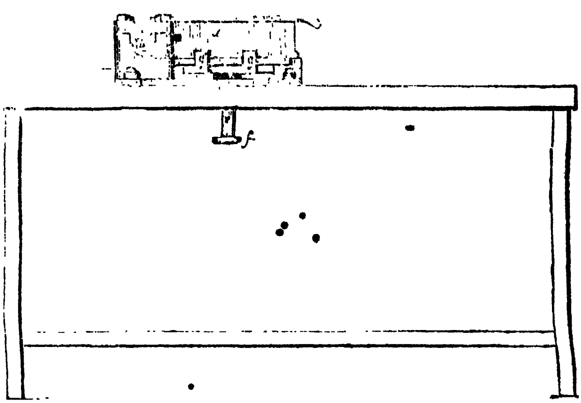
BRICK-MAKING MACHINERY.

Mr. Beart, of Godmanchester, Hunts, has patented the following invention for mounting an ordinary brick-mould on an axis at one end, in such manner that it may be turned over, and the brick be delivered by means of a piston, which, at the time of filling the mould with brick-earth, constitutes the bottom of the mould.

Fig. 1, represents an elevation of a brick-making machine.

Fig. 2, is a plan thereof; and

Fig. 3, shows the mould in section, whereby the parts not clearly shown in the other figures will be more readily understood; and it should

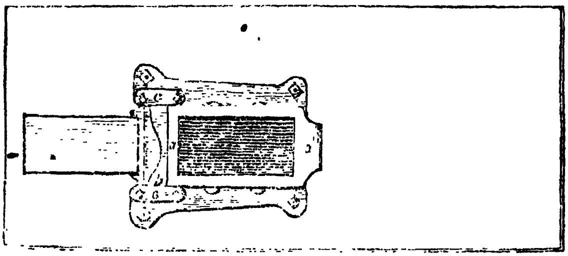


be remarked, that in each of these figures the same letters indicate similar parts; *a*, being the mould, which is shaped similarly to ordinary moulds. *b*, is an axis affixed to the left-hand end of the mould, which turns in the two bearings, *c*, *c*, affixed to the top of the machine. *d*, is the piston by which the brick, when formed and turned over, is forced out of the mould. *e*, is the piston-rod, having a stop, *f*, by which it is prevented coming too far through the mould. The piston-rod, *e*, passes through the guide, *g*, which is affixed to the under part of the mould, *a*,

* Philosophical Magazine, No. 41.

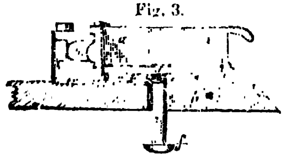
as is clearly shown in the drawing. *h*, is a slit or opening through the top or bed of the machine, in order to allow of the passage of the piston-rod.

Fig. 2.



The manner of using the invention is as follows:—The mould, *a*, being in the position shown at fig. 1, a quantity of brick-earth is to be placed therein, in like manner to that pursued in moulding bricks in the ordinary way when moulding them by hand, and the upper surface is to be struck off in the usual manner. The mould is then turned over on its axis, a board having been previously placed ready to receive the brick, which is now to be pressed out of the mould by the piston-rod. It is necessary here to remark, that the piston, *d*, consists of a plate of metal, around the edges of which are perforated holes, in order to allow of the surface being covered with a piece of skin of the horse with the hair on, or other suitable material may be used, such as woollen cloth, whereby the piston will more readily separate from the brick-earth than would be the case were the piston to have a hard smooth surface.*

Fig. 3.



THE PLYMOUTH BREAKWATER.

At the Royal Institution, on March 6, Mr Hosking gave "Some account of the Breakwater in Plymouth Sound," and illustrated the subject by the aid of drawings and models, and observations upon the site, form, construction, present condition, and proposed state of this great national work.

Mr. Hosking commenced by remarking upon the comparative advantages of Portsmouth and Plymouth as naval stations. He then adverted particularly to the position of the Plymouth Sound at the mouth of the Channel, unprotected by the opposite coast,

* Repertory of Patent Inventions, No. 22.

which extends but a very few miles westward of its meridian, and thus leaves it exposed to the full roll of the Atlantic; whilst it is not only unprotected by any natural barrier, but its funnel-shaped form is such as to increase the effect of the sea in a southerly, or south-westerly gale, as it rolls up to its head and into its harbours.

Early in the present century these circumstances engaged the attention of government; and in 1806 the late Mr. Rennie, and Mr. Whidbey, then master-attendant at Woolwich, were commissioned by Lord Howick (the present Earl Grey), at the time at the head of the Admiralty, to examine and report whether, by any, and what means, Plymouth Sound could be made an efficient and practicable haven for fleets. They examined and reported accordingly to the Admiralty, stating several modes, which had been suggested, of effecting the object in a greater or less degree, but recommending the formation of an extended dike of stone, to be about a mile in length, and to lie across the Sound between Bouvisand Bay and Cawsand Bay, leaving open the two lateral channels up the Sound by those bays, and closing the midway channel. This, however, was the worst, and was greatly obstructed by shoals, upon one of which, indeed, the dike or breakwater would be placed.

The execution of this work appears to have been forthwith determined upon; but the order in council directing its commencement, was not issued until June 1811; and the first stone was deposited on the late King's birthday, in August, 1812. The plan adopted seems to have been, in every respect, that recommended by Messrs. Rennie and Whidbey; the former of whom was constituted engineer, and the latter superintendant of the work. Oreston, at the head of Catwater, was the place selected to furnish material, and twenty five acres of limestone rock were purchased of the Duke of Bedford; and the quarries there have furnished almost the whole of the enormous mass of which the Breakwater is now composed.

The Breakwater consists of a centre and two wings. The centre is a thousand yards in length, and the wings, which are called kants, are bent upon the centre inwards, at an angle of 120°; and each kant measures 350 yards in length on the top surface. About 500 yards of the central part rests on the shoal and rocks called the Shovel, and the rest of the work is in deeper water—the extremity of the eastern arm being in about five fathoms, and that of the western in seven fathoms' water. Mr. Rennie proposed to make the top about ten feet above low water level, ten yards wide, and to extend it inwards, or towards the land, two feet horizontal for every vertical foot; and outwards, or on the sea side, at the rate of four to one, so that in the deeper parts the base would have been about seventy yards transversely.

The original mass of the Breakwater is composed of rough rubble stones, principally small stones of about a ton weight, or

containing seventeen or eighteen cubic feet in bulk each; a considerable proportion is from one ton to three tons, and from that again to five tons, but latterly stones of generally larger capacity have been used.

The advantages afforded by the Breakwater were soon apparent. Before half its length had appeared above low water, the swell at the head of the Sound was so much broken down, that the fishermen could no longer judge, by the state of the Sound within the mole, of the weather beyond it, or at sea. Ships ran in behind it and rode out the worst weather in safety; and in January, 1817, during a tremendous storm, a deeply laden collier lay under cover of the breakwater, and received no injury, whilst two king's ships, which were anchored in the Sound, were driven on shore, and both lost.*

However, the work itself did not escape injury, for an extraordinarily high tide lending its influence to the storm just referred to, about 200 yards of the superstructure were destroyed, although it consisted of the largest stones, whilst the parts under water remained undisturbed. This fact, Mr. Hosking remarked, seems to have excited surprise, though nothing was more natural. It is well known that the disturbance of the sea in gales of wind extends to a comparatively small depth, though the force with which it acts within that depth is very great indeed. Now, when it is remembered that a block of marble immersed in sea water, offers but three fifths or thereabouts, of its weight in air, of resistance to any disturbing power, it will be easily understood why stones of from three to five tons in weight placed within that range of depth from the surface throughout which the action of the sea, in a gale of wind, extends, may be hurled from a summit, whilst stones of smaller bulk lie undisturbed on the surface of the slope lower down, or at a greater depth from the surface of the sea, even on the exposed side of the structure. What is most surprising is, that the practical experiment made by the sea at the time referred to, when the Breakwater had not been extended half the length intended, did not make it clear that stones, however large, if placed on a surface so low that they could be submerged, and so detached that they could be immerged, within the action of a powerfully disturbing force, must be deranged by it. Nevertheless, the injured part of the Breakwater was restored, and the work was pursued in the same manner, until another similar warning occurred; but since this latter, a considerable part of the main body, or centre, and part of the western kant or wing, have been covered from the level of neap tides up to the top on the outside, and on the top—which is but

* Mr. Hosking omitted to state that the sea, after having broken through the Breakwater for a considerable length, actually broke across the isthmus, connecting Mount Batten with the mainland, at the head of the Sound, and destroyed two Danish ships which lay at anchor in Catwater.—Editor of *the Athenæum.*

two feet above high water of spring tides,—and on part of the slope downwards from the top on the inside, with wrought and bedded limestone masonry with granite bond and curb. This covering will, doubtlessly, resist the action of the sea far better than previous rubble work, every block of which is acted upon by the whole force which the sea can bring to bear upon its surface, whereas the jointed and otherwise connected blocks offer the surface of one of their sides only to the action, and aid each other in resisting it. It must be evident, nevertheless, Mr. Hosking continued, that masonry laid in a flat or slightly inclined plane, as this is, is more open to disturbance than it would be if every stone were aided by the superincumbent force which the gravity of that above it would supply, if the plane be a steep, instead of a slightly inclined one, and if the upper part of the construction be so high, as not to be liable to be immersed. Now, in the present case, the toe of the masonry on the outer and upper slope, which is at an inclination of one in five, is within the range of the more powerful action of the sea, so that if the loose rubble which abuts it,—and which it is absurd to suppose can be secured by wedging,—be disturbed, the whole casing will fall away like a house built with cards. It is true, that what is termed a fore-shoe, has been made in front of the masonry, for the purpose of protecting, or rather forming, its abutment; but if the sea does, as it most assuredly will, distribute the rubble on the outer, or sea side, in such a plane as the law in such a case requires,—he meant the law which nature has made for the formation of a shore with rubble stone,—the abutment will be destroyed, and the masonry will become rubble, to be thrown over into the Sound on the inner side, as had happened to the rubble that preceded it. Mr. Hosking thought it very clear, that if a crest or curb of rubble blocks could not be maintained at the upper edge by the upper surface or top, where the sea but seldom reached to dislocate it, it was a hopeless attempt to form such a one where it is constantly acted upon, and where the blocks are always nearly half floated; and that is the case with the outer edge of the fore-shore just referred to.

The western kant or wing is terminated by a circular head, and in this the difficulty will be still greater of maintaining any construction of rubble, or of masonry bedded upon rubble, that could be subjected to the action of the sea, since the kant is so arranged as to receive the sea in a southerly or south-westerly gale, so nearly at right angles that the end will be constantly eaten away, how well soever the body of the work generally may be protected by a sea wall, or otherwise. Mr. Hosking thought there was an absolute necessity that a wrought masonry structure should be formed on this end, and be commenced so low down as to be secured against the action of the sea tearing the rubble away from before and beneath it. This should be carried up high enough above the highest surface level of the sea, to

obtain weight within itself to maintain the immersed parts in their places. Indeed, it is proposed to build a light-house there; but Mr. Hosking expressed it as his opinion that, if this is based on the surface of the present construction, it could never be secure.

In the straight parts of the work, the best protection it could have, would be a sufficiently thick wall, faced with granite, built along the top as before suggested, so high that its mass could never be immersed; and Mr. H. showed that by giving its face a receding concave form, the force of the sea would be expended in rising up it, whilst a deep blocking course might project and present an inverted concavity which would have the effect of turning the crest of the wave and throwing it back upon itself. The blocking course being of granite, which is much heavier than limestone, would offer a much greater resistance by its gravity alone; and as the wall could not be wholly submerged the mass would give the resistance of its whole weight, and not the difference of its specific gravity merely. At all events, the work should not be left as it now is, the western extremity a crude heap of rubble, hourly exposed to the same disaster that befell it in 1824; and the uncovered part of the main body, from about the middle eastward, where the work suffered so severely both in 1817 and 1824, likewise exposed to have its superstructure again hurled into the Sound.

Mr. Hosking argued that the direction of the eastern kant is that which would have been best for the whole work, since this receives the sea, in the gales most to be guarded against, obliquely, and remains comparatively uninjured by the worst. In that case, the Breakwater would have ranged across the shoal called the Panther, and have masked some very dangerous rocks as well as the shoal itself, whilst a projection of about 150 yards beyond it, would have locked the Sound with Penlee Point as much as the present western extremity does, and have received the sea so obliquely upon its end, moreover, as not to be exposed to the erosion to which the present construction is subjected, by receiving the run of the sea upon its exposed head transversely.

Mr. Hosking concluded with some remarks upon the cost of the Breakwater, up to the present time, and upon the quantity of material which it contained. He observed that the work had been carried on latterly by contract, in which manner it was found that deposits could be made at the rate of three or four shillings per ton, whereas in the orignal estimate the material had been calculated at seven or eight shillings, which cost, indeed, it considerably exceeded while the government conducted the operations at its own risk and with its own machinery. The contractors employed steam power to convey the material, and did not wait for wind and tide as the custom had been, and not only did their work at half the cost, but in half the time, that had been calculated upon.

(In giving the usual notice to the members of the Institution of the subject for the following Friday evening, Mr. Faraday took occasion to remark, that the statement which Mr. Hosking had made as to the limited range of the more violent action of the sea in storms, was borne out by the experiments of Mr. Deane, who had found that the agitation of the sea, under such circumstances, did not extend more than ten or twelve feet below the surface.)

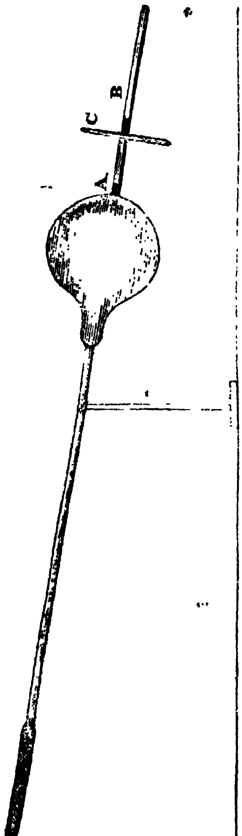
MANUFACTURE OF GLASS.

MESSRS. HARTLEY, of West Bromwich, have patented the following improvement in the manufacture of Glass.

Their invention relates to part of the manufacture of crown glass, used for glazing windows and other purposes. It is well known that this description of glass is produced from the metal by blowing the same into the form of globes, and afterwards by means of the operation called "*flushing*," such globes are thrown open into flat circular plates called tables. Now this invention relates to that part of the process of manufacture which consists in blowing the metal into globes. According to the ordinary process, the metal when taken from the pot by the pipe is rolled on a smooth iron surface in order to bring the outer end of the metal to a conical form the extreme end of which becomes the outer axis of the globe during the operation of blowing and working the glass into the required form. This outer axis is called the bullion. During the expanding of the metal into the globular form the workman rolls the bullion along a straight edge or bar called the bullion bar, as is well understood. In doing this the outer end of the glass globe whilst expanding and continually revolving rubs against the bullion bar, by which action parts of the surface of glass is disturbed or made irregular, and as the globe extends in dimensions this rubbed surface enlarges, the consequence is that when the table of glass is complete there are at all times more or less waved lines for some inches around the bullion or the centre of the table of glass, which lessens the value of so much of the table. This prejudicial appearance is produced to the glass as before stated by that part of the surface coming in contact with, and rubbing against, the bullion bar when the metal is in a soft and pliant state Now the object of this invention is to dispense with the bullion bar, and to supply its place by the application of a tube or hollow bearing for the bullion or outer axis of the globe of glass during the expansion of the same ;* by this means that part of the surface which was heretofore rubbed against the

* Athenæum, No. 385.

bullion bar, is, when worked according to the present invention, in no way prejudicially acted on, and the waved appearance before consequent on the manner of operating is avoided.



The cut represents an ordinary pipe with a globe of glass, the bullion, *a*, being supported by the tube, *b*, in which it is caused to revolve by the workman when working the metal into the globular form desired during its expansion. On the tube, *b*, is placed a shield, *c*, which is intended to prevent the heat, coming from the heated glass, injuring the hands of the boy who holds the tube. The workman in performing this part of the process of manufacturing glass takes a proper quantity of metal on the end of the pipe and proceeds to form the outer end of such metal into a cone, he proceeds with the process in like manner to that heretofore pursued till the globe of glass requires support at the outer end by its axis or bullion, *a*, that is to say, he proceeds in the ordinary manner up to the period at which (according to the old means of operating) the bullion would have been rested on, and revolved, and run along the bullion bar, but, in place of so running it along the bullion bar, a boy holds the tube or hollow bearing, *b*, in such manner as to receive the bullion, *a*, and the workman causes the globe to revolve till the globe is sufficiently expanded. The same is then to undergo the operation of flashing as heretofore.

Having thus described the nature of our invention, and the manner of carrying the same into effect, the patentees urge their invention to consist in the application of the tube or hollow axis, *b*, in place of running the bullion along the straight edge called the bullion bar, as above described.*

* Repertory of Patent Inventions, No. 19.

CHEMICAL SCIENCE.

MADDER

Is such an important article in the art of dyeing, that its proper culture and natural history have justly attracted the attention of chemists. Schlumberger, a German, has lately published an account of a series of experiments, which he has made for the purpose of determining the causes of the difference between the madder of Alsace, and that raised in Avignon; from which he has inferred, that carbonate of lime is indispensable; that, when we wish to dye red and violet colours with madder upon cotton with an alum or iron mordant, if we use Avignon madder, the addition of lime is, in general, unnecessary, because it naturally contains carbonate of lime, except in a few instances where the plant has been raised on a soil containing little calcareous matter; while the Alsace madder which contains only a small portion of lime, although it can produce as deep a shade as the former, yet does not form so permanent a colour: but when lime has been added, the dye is equal to that of Avignon. Besides lime, there are several other substances which produce standing colours with madder. These are in the order of their power, carbonate of lime being the best, phosphate of lime, carbonate of magnesia, hydrous protoxide of lead, protoxide of zinc, carbonate of zinc, protoxide of manganese, hydrous peroxide of manganese, hydrous protoxide of cobalt, acetate of lime, and phosphate of cobalt. The Avignon madder loses its permanence when treated by acid which dissolves the salt of lime.

M. Robiquet, who along with Colin and Logier has been paying much attention to the subject, although he does not deny the truth of the facts to a certain extent, brought forward by the German chemist, ascribes them to a different cause. He affirms, that lime is not necessary for obtaining permanent madder colours, and indeed, that its presence impedes good dyeing. He has found in madder, two colouring matters, *alizarine* and *purpurine*, which vary in their relative proportions, according to the nature of the soil, the cultivation, climate, and age of the root. In most of the acids, *alizarine* is insoluble, so that when an acid is present, this colour cannot be fixed. The Avignon madder contains no free acid, while the Alsace madder does, as is apparent from its yellow colour. The latter contains much *pur-*

purine, and is therefore, better fitted than the Avignon madder, for dyeing lake colours, the agent necessary being *purpurine*. A hot solution of alum dissolves the *purpurine*, and does not attack the *alizarine*, which is remarkable, because, when the latter has once combined with alumina, the affinity is very strong. Robiquet, infers therefore, from these circumstances, that it is not the same colouring matter which becomes alternately fixed or fugitive, according to the presence or absence of chalk, but that it is owing to the existence in the madder of two distinct colouring matters, one of which, the *purpurine* is soluble in acids, and can, therefore, readily be brought in contact with the mordant, while the other requires neutrallization, previous to solution. Robiquet found that during boiling, carbonic acid was extracted from madder, which he considers as being either present naturally, or as being formed by the alteration of some of the principles during the process. At a temperature of about 300°, not only carbonic acid, but acetic acid also, without oil was discharged. Robiquet conceives, that the fine colour of Turkey red is owing to the combination of the two colouring matters, and that the fixation of the purpurine is to be ascribed to the oil.*

EXISTENCE OF ARSENIC IN PHOSPHORUS.

M. Hertn, a druggist of Berlin, found that some phosphoric acid, prepared according to the Berlin Pharmacopœia, by treating, phosphorus with nitric acid, became of a yellow colour after some time, on the addition of sulphuretted hydrogen. M. Barwald passed a current of sulphuretted hydrogen through phosphoric acid, prepared by the method above mentioned: from a pound of acid he obtained eight grains of a precipitate, which being mixed with carbonate of soda was decomposed in a glass tube by dry hydrogen. In the upper part of the tube a metallic layer was deposited, which from its appearance, and also from the odour of garlic which it emitted when thrown on sea coals, was unquestionably determined to be metallic arsenic. Some other portions of phosphoric acid, procured from other druggists at Berlin, gave the same results. M. Barwald satisfied himself that neither the vessel used, the nitric acid, nor the sulphuretted hydrogen contained any arsenic, and that this metal came from the phosphorus. He learnt from another druggist that water in which phosphorus was long kept also contained arsenic. This fact was confirmed by Wittstock; but phosphorus which he himself prepared did not contain any arsenic. His experiments also showed that a considerable quantity of arsenic might be mixed with phosphorus without materially altering its appearance; but, according to the proportion of the arsenic, its colour was deeper and of a more marked yellow grey, especially at the

* Annales de Chimie.

surface: if the quantity of arsenic was very considerable, its colour was steel grey, but it was soft and ductile like wax. M. Barwald attributed the presence of this metal in the phosphorus to the sulphuric acid employed to prepare it. M. Liebig also satisfied himself that the phosphorus bought of the druggists of Frankfort contained rather a large quantity of arsenic. He found, as the chemists already mentioned had done, that during the oxidation of the phosphorus by the diluted nitric acid, phosphorous acid is principally formed; and he also observed that when this acid solution was evaporated to expel the nitric acid, there was developed phosphuretted hydrogen when it had arrived at a certain degree of concentration, and this reduced the arsenic or arsenious acid which it contained, and a black heavy powder was deposited, which was metallic arsenic. M. Liebig proposes, in order to purify phosphoric acid, to substitute phosphorous acid for sulphuretted hydrogen, this latter requiring several days for its action. The process which he proposes is the following: oxidize two parts of phosphorus by dilute nitric acid, and evaporate the liquor until the arsenic is deposited; at the same time there is to be placed in a funnel, deposited in a cellar, one part of phosphorus in a glass tube; the phosphatic acid which is obtained is to be used to purify the phosphoric acid a second time when diluted with water: the mixed liquors are to be evaporated, and if arsenic is again deposited, the operation is to be repeated until no effect is produced by the addition of phosphatic acid.

The above is extracted from the *Annalen der Pharm.* 1834. The editor of the *Journal de Chimie Medicale* adds, that some experiments which he had made showed that some phosphoric acid which was prepared fifteen years since contained arsenic, but they had not found it in any other specimen, nor in the water in which phosphorus had been kept for four years.*

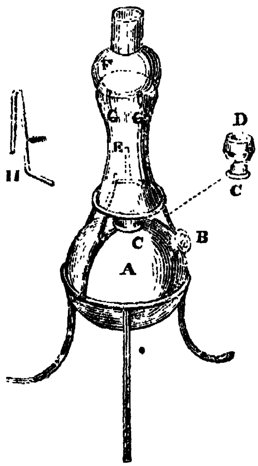
DESCRIPTION OF A NEW SPIRIT-LAMP FURNACE.

By Arthur Trevelyan, Esq.

HAVING lately been engaged in following out chemical analysis under the able direction of William Gregory, M. D., Edinburgh, I found that a lamp for generating a great heat would be highly useful, and was much wanted by the analytical chemist. After experimenting to a great extent with many modifications of the lamps of Berzelius and others, I found that they all wanted power, and when used for a length of time, attained such a temperature that the spirit boiled and flowed over. After continuing these experiments for nearly three months, I had almost relinquished them in despair of success, when I accidentally became acquainted with Andrew Whelpdale, a young and promising chemist, to whom I stated my difficulty: he recommended, if it

* Journal de Chimie Medicale.

could be contrived, that the vapour of alcohol should be used. I immediately came into his view, and had a lamp constructed, of which a drawing is inclosed (see the figure). After trying it



with different burners, a stop-cock and safety-valve (neither of which is necessary) and differently formed chimneys, it was brought to a state of perfection and power which we little expected. It fused liquid as water, 500 grains of bicarbonate of soda in fifteen minutes, consuming three ounces of alcohol, and I think might do it in less time, but the chimney was rather small for the size of the platina crucible used: the ends of the brass uprights attached to the rim on which the chimney stands were fused in a similar experiment.

From its great power I think it may be called emphatically the "Lamp-furnace."

It may be made of any size, but the chimney must be suited to the crucible, round which the flame should play freely.

The vapour may be generated by a spirit-lamp placed underneath the globe.

My friend Dr. W. Gregory, exhibited this lamp on the 11th of September to the Chemical Section of the British Association at its late meeting in Edinburgh.

A. Copper globe for holding the alcohol, with botton lightly concave to concentrate the flame of lamp placed below.

B. Opening covered with screw-cap, for introducing the alcohol; a conical safety-valve with worm spring may be attached if wished.

C. Screw shank of Argand burner.

D. Argand burner pierced with ten holes: this burner is the same as the gas burner used in Edinburgh, but with half the number of holes.

E. Copper chimney within which the crucible is to be placed.

F. Cupola, open at top.

G. Ends of wires, similar to that marked H: there are three of these with the ends inside, on which the crucible rests, bent at right angles.*

PYROXILIC SPIRIT.

By M. S. Leibig.

In distilling wood vinegar, wood spirit is obtained, which strongly resembles alcohol, but is very impure. To purify it after rectifi-

* Philosophical Magazine, No. 40.

cation, it is saturated with chloride of lime, which it dissolves, it is then allowed to settle. An empyreumatic oil which it contains, separates and swims on the surface. It is distilled a third time, and in order to separate the water it is rectified several times over chloride of calcium. Pure wood spirit is a colourless fluid with the penetrating smell of ether, possessing the taste of pepper. It boils at 140°. Its sp. gr. is 0·804 at 64½°. It burns with a blue dim flame. It consists of

Carbon	. . .	0·5382	3 atoms.
Hydrogen	. .	0·1097	5 ,,
Oxygen	. . .	0·3510	1 ,,

and therefore may be considered as formed of

Ether	. . . .	1 atom.
Oxygen	. . .	1 ,,*

KREOSOTE.

HUBSCHMANN has simplified the process for preparing this substance, which at first promised to be of so much importance both as a medicine and antiseptic. (*Ann. de Chim.* lvii. 105.)† He distils tar oil as it is afforded in this process for obtaining pyroligneous acid, in a large retort with a small portion of sand, in order to increase the number of bubbles which are formed during ebullition, and thus diminish its violence. What comes over at first, consisting of eupion, acetic acid, &c., is laid aside, but whenever a liquid begins to appear which falls drop by drop into the receiver, the latter is to be changed, and the distillation continued until the mass become foamy. The product of the distillation is then poured into a vessel with about double its volume of water, to which a sufficient quantity of sulphuric acid has been added to enable the fluid containing the kreosote to swim on the surface. The liquid is then boiled for some minutes. After cooling, the colourless liquid below is separated, and the brown oil is rectified in a retort. The product may again be subjected to the same treatment with sulphuric acid and water. The colour is still brown, but after being separated from eupion it is pale-yellow.

In order to separate the eupion, the rectified product should be dissolved in a solution of caustic potash, according to Reichenbach's method.

The supernatant oil is separated, the ley heated, and after cooling, it is converted by sulphuric acid into a solution of sulphate of potash and kreosote, which swims on the surface. The latter may be obtained colourless, by washing it in water mixed with a slight excess of solution of potash, and then distilling it. Hubschmann considers that, as an agent in medicine, its powers

* Journ. de Pharm. v. 32.

† See Arcana of Science and Art, 1835, p. 142.

have been greatly overrated, and that the only use which ought to be assigned to it is its application for ameliorating the pain of carious teeth.*

PREPARATION OF CANTHARIDINE.

M. Thiery procures this substance by the following process:—

Reduce cantharides to powder, and digest it for some days either in ether, etherized alcohol, or alcohol of sp. gr. ·847; the solution is to be separated, the residue washed with more alcohol, and the last portions of alcohol are to be displaced by water. The mixed liquors are to be subjected to distillation; on cooling, numerous small crystals of canthridine are deposited on the surface of the liquor. This liquor consists of two distinct portions; the upper one is a green oil, which contains the crystallized canthridine; the lower one is a brown liquor: they are separable by a funnel, and the oil mixed with cantharidine is placed upon a filter, and when heated in a stove, the oil passes through the filter, and the cantharidine remains upon it. The cantharidine thus procured is still mixed with oil, which is to be separated by pressure between folds of paper; the purification is completed by dissolving the cantharidine in boiling alcohol, from which it is deposited on cooling in the form of scales: the solution in alcohol, with the addition of animal charcoal, is to be repeated.

Cantharidine thus obtained has the following properties:—It is inodorous; when heated to 400° Fahr. it melts; and if the heat be continued, it is converted into white vapours, which condense in small crystals on the sides of the vessel.

Concentrated and boiling sulphuric acid dissolves cantharidine; the solution has a light brown colour: when diluted with water, it deposits canthridine in small needles.

Boiling nitric acid dissolves it without any change of colour; the solution deposits small crystals on cooling, and the same effect is produced by muriatic acid.

Potash and soda dissolve cantharidine; and if concentrated acetic acid be added to these solutions, the cantharidine is deposited in small crystals. Ammonia has no action on cantharidine.

Oil of turpentine, olive oil, and oil of sweet almonds dissolve cantharidine when hot, but it deposits on cooling.†

GALLIC ACID SPEEDILY PREPARED.

According to Döbereiner, gallic acid may be prepared by mixing a concentrated infusion of galls with acetic acid, in order

* Records of General Science, No. 3.

† Journal de Chimie Medicale.

to decompose the gallate of lime; it is then to be shaken for a few minutes with ether, which takes up much gallic acid; the ether is to be slowly evaporated, and gallic acid is obtained in a very short time in small colourless crystals.*

PRESERVATION OF DELIQUESCENT SALTS.

M. Druchar recommends that a few drops of oil of turpentine should be put into the bottle, and when it is diffused the deliquescent crystals should be introduced.†

COMPOSITION OF THE ATMOSPHERE.

M. A. Chevallier is at present occupied with researches on the composition of the atmosphere; he states the following as the results already obtained:

1st. In general, the air of Paris and of many other places contains ammonia and organic matters in solution.

2nd. If the water deposited from air (dew) by cooling be examined, it is found to contain ammonia and organic matters.

3rd. The quantity of ammonia contained in the air is often pretty considerable.

4th. The presence of ammonia is easily explained, because this gas is produced under many circumstances.

5th. The composition of atmospheric air may vary in certain localities, from a great number of particular circumstances, as the nature of the combustible employed in great masses, the decomposition of animal and vegetable matters, &c. &c. The air of London contains sulphurous acid, that of the sewers of Paris contains acetate and hydrosulphuret of ammonia; air taken near the *bassins* de Montfaucon contains ammonia and its hydrosulphuret.‡

THE STRUCTURE AND ORIGIN OF THE DIAMOND.

By Sir David Brewster, K.G.H. LL.D. F.R.S. &c.§

In the year 1820 I communicated to the Royal Society of Edinburgh an account of a very singular fact relative to the structure of the diamond, and I added to this communication some conjectures respecting the origin of this remarkable gem. As these conjectures have been referred to by some late and able writers on the diamond mines of India without sufficiently separating the fact from the conjectures, and as I consider the structure which I discovered around the cavities in this mineral as a lead-

* Journal de Chimie Medicale.

† Ibid. ‡ Journal de Pharmacie.

§ From the Transactions of the Geological Society, N.S., vol. iii. p. 455. See Philosophical Magazine, vol. iii. p. 220.

ing fact in the natural history of this gem, I have been induced to re-examine it with care, and to make a drawing of the phenomena which it presents.

In order to bring all the facts into one view, I shall make no apology for quoting my original observations.

"Had the diamond not been placed at the head of the mineral kingdom, from its unrivalled lustre and high value as an ornamental gem, it would have attained the same distinction from its great utility in the arts. Separated from all other gems by its remarkable refractive power, and from all mineral substances by its extreme hardness, its chemical composition, and its locality in the crust of the earth, it has always been regarded as an anomalous substance which set even speculation at defiance.

"When Sir Isaac Newton compared the refractive power of several bodies, he remarked that amber and the diamond had a refractive power three times greater in respect of their densities than several other substances, and he conjectured that the diamond was probably an unctuous substance coagulated. This relation between the inflammability of bodies and their absolute refractive power I had an opportunity of confirming and extending by ascertaining that sulphur and phosphorus exceed even the diamond in absolute refractive power, and that these three simple inflammable bodies stood at the head of all other solid and fluid substances in their absolute action upon light.

"In this arrangement, amber stood next to diamond; and as both these substances had a similar locality, and had also carbon for their base, it became of some importance to discover that their general polarizing structure was the same. The analogy, however, to which I wish to direct the attention of the Society is founded on the existence of small portions of air within both substances, the expansive force of which has communicated a polarizing structure to the parts in immediate contact with the air. This structure is displayed in four sectors of polarized light encircling the globule of air, and can be produced artificially either in glass or in gelatinous masses by a compressing force propagated circularly from a point. It is obvious that such an effect cannot arise from any mode of crystallization; and if any proof of this were necessary, it might be sufficient to state that I have never observed the slightest trace of it in more than 200 mineral substances which I have examined, nor in any of the artificial salts from aqueous solutions. It can, therefore, arise only from the expansive force exerted by the included air in the diamond and the amber, when they were in such a soft state as to be susceptible of compression from so small a force. That this compressible state of the diamond could not arise from the action of heat is manifest from the nature and recent formation of the soil in which it is found; that it could not exist in a mass formed by aqueous deposition is still more obvious; and hence we are led to the conclusion rendered probable by other analogies, that the diamond originates, like amber, from the consolidation of, perhaps, vegetable matter, which gradually acquires a crystalline form by the influence of time, and the slow action of corpuscular forces.

"As the preceding results were obtained from flat diamonds, which did not seem to have been regularly crystallized, I was anxious to detect the same structure in those which had a regular crystalline form. With this view I examined several of the diamonds in Mr. Allen's collection, and was fortunate enough not only to detect in a perfect octohedral crystal the same structure which I had observed in the flat specimens,

but also an air-bubble of considerable size, which had produced by its expansion the polarizing structure already described."

Since these observations were written, Dr. Voysey has shown that the matrix of the diamonds produced in Southern India is the sandstone breccia of the clayslate formation; and Captain Franklin has found that in Bundel Khund the rocky matrix of the diamond is situated in standstone which he imagines to be the same as the new red sandstone of England, that there is at least 400 feet of that rock below the lowest diamond beds, and that there are strong indications of coal underlying the whole mass. The following are Captain Franklin's observations on the origin of this mineral:—

"There is another circumstance to which I must advert, but I do so with diffidence, and under a hope that it will be considered merely conjectural. Dr. Brewster supposes the diamond to have originated like amber, perhaps from the consolidation of vegetable matter, and that it gradually acquired its crystalline form by the influence of time, and the slow action of corpuscular forces. The late Dr. Voysey adverted to this opinion in his account of the diamond mines of Southern India; and on the occasion of publishing an abstract of that paper in his Journal of Science, Dr. Brewster observed that he saw no reason to alter his opinion. Now, as the rock matrix of the diamond of *Panna* appears, in some respects, though not altogether, to resemble that of *Banganpilli* in Southern India, there would seem to be little chance of any conjecture being useful; still, however, as every opinion regarding the origin of this fine mineral is as yet theoretical, I will not withhold what occurred to me on this subject, though I again repeat that I offer it with great diffidence. The theory of Sir James Hall on the consolidation of strata frequently recurred to me when examining the sandstone in which the diamond is found: I thought that I could discern much in favour of it, and particularly in the gradual changes of its nature from the lower to the upper strata. Now, if the principle of this theory is admitted to be correct, and applicable universally, it follows of course that it must be applied here; and then it may be questioned, how the diamond was preserved under that degree of heat which must have been necessary to form its matrix the gritstone? In answer to this objection, I suggest that the circumstance of calc spar occurring in trap rocks is somewhat analogous; and if it is admitted that compression under the weight of strata and a superincumbent ocean had the effect of resisting the expansion of its carbonic acid, and constraining it to continue in combination with lime, might not the same principle be reasonably enough applied to account for the preservation and detention of the elements of the diamond in the gritstone? And, again, should it be further shown that crystals, such as those with which we are familiar in nature, may be produced by slow cooling, or other processes, according to the above theory, may we not look to it also to account for the crystallization of the gem?

"This conjecture rests upon the truth or fallacy of Sir James Hall's theory, or on a modification of it; and when this theory is considered as the result of long and patient experiment, and the high reputation of its author is taken into account, it will require something more than limited observation or ordinary ability to answer its objections; my part, however, is merely the suggestion of a traveller, and I therefore conclude my

paper by expressing a hope that this important mineral may meet with more able investigation."

This discovery of a new matrix of the diamond takes away the foundations of the argument from which I concluded "that the compressible state of the diamond could not arise from heat," for it is possible that the rocky matrix in which it was found had an igneous origin; and Captain Franklin's supposition that it might be fused under compression, is quite conceivable.

But, though I admit the possibility of the diamond having been in a state of igneous fusion, I consider it highly improbable that it was so. In the laborious examination, which I carried on for several years, of the cavities in topaz, quartz, amethyst, chrysoberyl, &c., and in salts formed from aqueous solutions, I had occasion to observe the condition of many thousands of cavities, and in no one case, neither in crystals which exist in rocks known to be of igneous origin, nor in crystals artificially formed, have I been able to discover a single cavity in which the expansible fluid which it contained had compressed the surrounding mass, and communicated to it the polarizing structure existing around the cavities in the diamond.

Now, in glass which is known to have been in a soft state, and in amber, which is generally allowed to be an induratad gum, I have discovered cavities similar to those in the diamond, and surrounded by the same polarizing structure; a structure which could only be produced by a compressing force emanating from these cavities.

As I am desirous that mineralogists should thoroughly understand the nature of this structure, I have made two drawings of the diamond Laske which contains the cavities under consideration.

Fig. 1.

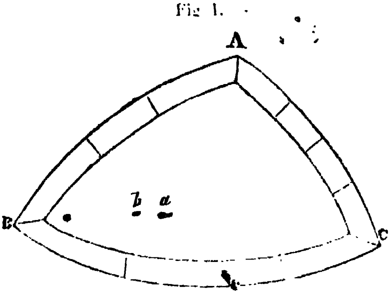
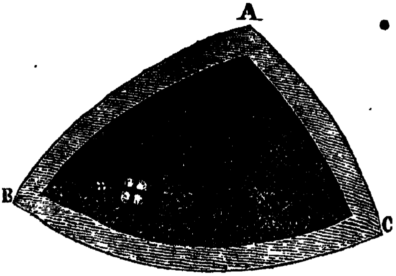


Fig. 1, represents the diamond considerably magnified. At *a* and *b* are seen two minute cavities, which appear perfectly black, as if they were filled with opake matter. This blackness, however, arises from the high refraction which takes place at the concave surfaces of the cavity, as may be proved by the application of a microscope, which exhibits a minute pencil of light transmitted through them. Fig. 2, shows the four luminous sectors around each cavity, as exhibited by the agency of polarized light. When a plate of sulphate of lime which polarizes a blue tint of the second order of colours in Newton's scale is placed across

these sectors, so as to have its axis coincident with the radii of two of the luminous sectors opposite to each other, and perpendicular to the radii of the other two sectors, its blue tint of the second order is depressed, by that which is polarized by the sectors, to a red of the first order in the sectors whose radii are coincident with the axis of the sulphate of lime, and raised to a whitish yellow of the second order in the other two sectors. Hence, it follows that the character of the polarization in the sectors is negative, like that of calcarious spar, and that it has been produced by a compressing force acting outwards from the cavities.



I have, in a former paper, supposed that the compressing force was the expansive power of air included in the cavity; but this, of course, is a conjecture, though it seems quite certain that it must have been a gaseous body. That it was not a fluid is obvious, from there being no fluid in the cavities. This was certainly the case in the cavities in amber and glass; but it is possible that a fluid of very low refractive power may exist in the diamond cavities without my being able to see it, on account of the high refractive power of the gem. If this should be the case, however, it will not be difficult to observe it in larger cavities, if they should ever be discovered.

The existence of a compressed structure round the cavities clearly proves that the diamond has been in a soft state; but it may be shown, from various considerations, that this softness was not the softness produced by igneous fusion, and that it is likely to have been the softness of a semi-indurated gum. I have already stated that no such cavities exist in minerals of igneous origin; a fact which entitles us to separate the diamond from that class of crystals; and it is equally important to observe that its polarizing structure, which I have studied with peculiar care in a great variety of specimens, connects it closely with amber and indurated gum. From such substances, indeed, it differs in having a distinct crystalline form; but in the mineral resin called mellite we have an equally distinct crystalline form, though there can be little doubt, both from its composition and its locality, that it derives its origin from the vegetable kingdom.*

Philosophical Magazine, No. 40.

METHOD OF DESTROYING MICE, &c., IN THEIR LURKING PLACES.

M. Thenard, in 1832, submitted to the Academy of Sciences a plan for destroying noxious animals, when they have taken refuge in their hiding places. The instrument of destruction is sulphuretted hydrogen, which he had remarked to be peculiarly deleterious to animal life. Animals when allowed to breathe the pure gass fall down as if struck with a bullet. Even when considerably diluted with atmospheric air, the effects are deadly. A [illegible] dies in less than a minute, in air containing $\frac{1}{250}$ of this gas. A dog of moderate size is speedily killed in air containing $\frac{1}{1000}$ while a greenfinch expires in a few seconds in air possessing $\frac{1}{1500}$ of sulphuretted hydrogen. Influenced by these facts, the French chemist proposed the employment of this gas to several individuals for the purpose of extirpating noxious vermin, but his suggestions being treated with indifference, he determined to put the method in practice by his own experiments.

His first trial was in an apartment infested by rats, which showed themselves occasionally during the day, and at night were actively engaged in plundering a chest of oats, to which they had access through an aperture of their own formation. The holes by which they retreated amounting to 18 in number, Thenard adapted to each of them in succession retorts capable of containing half a pint measure, by introducing the beak of the retort and filling up the interval round its neck with plaster. Sulphuret of iron was deposited in the retort, formed from a mixture of iron filings, sulphur and water, and dilute sulphuric acid was introduced by means of a tube placed in the tubulure. The sulphuretted hydrogen was disengaged with great rapidity, and in a few minutes not a rat remained alive in the building. His next experiment was in an old abby where he was equally successful, and having opened up part of the wall he found many dead rats. He recommends the application of this method to the destruction of moles, foxes, and all animals which cannot be extirpated by the usual means. Thenard then gives popular directions for the formation of the materials required to produce the gas.

Mix 4 parts of iron filings, 3 parts flowers of sulphur in a mortar with a pestle. Place the mixture in a convenient vessel, and moisten it with 4 parts of boiling water, stirring it with a piece of wood or glass. Add gradually afterwards 4 parts more of water, and introduce it into the retort. Pour upon the mixture common oil of vitriol diluted with five times its volume of water, and continue to add it gradually till the effervescence ceases. Should any of the gas escape into the apartment and occasion inconvenience, it may be removed by dropping a little sulphuric acid upon bleaching powder. The holes should

be closed immediately, to prevent the disagreeable effects of the putrefaction of the carcasses of the animals which have thus been destroyed.*

MELLONI'S EXPERIMENTS ON HEAT.

At the Royal Institution, on the 23rd of January, Dr. Faraday commenced the lectures of the season by describing and exhibiting the experiments which Melloni, a young Italian philosopher now resident at Paris, contrived to elucidate the nature of heat.

The great improvement which he has introduced, and which bids fair to enable us soon to develope completely the cause of the phenomena dependent on the presence of this important principle, is the adaptation of the thermo-multiplier as a delicate indicator of sensible heat. All the experiments which had been previously made on this subject were performed by means of Leslie's differential thermometer, which, although comparatively, as to other instruments, a delicate contrivance, is surpassed in an infinite degree by the thermo-multiplier. The multiplier consists of about 30 pairs of bars of bismuth and antimony; the elements being so extremely delicately formed that the extremities present a surface of 4-10ths of an inch square. These are made to communicate with the multiplier, by means of wires leading from the extreme bars. The multiplier consists of a coil of silver wire, armed with silk, and having a magnetic needle so placed in a free space within the centre of the coil, as to enable it to oscillate readily. Now, it was observed by Melloni, that when heat, even that of the hand, is applied to the pile, a powerful effect is produced upon the needle of the multiplier, which undergoes an immediate declination, and traverses an arc more or less great if the heat is constant in a constant interval. It is quite obvious, therefore, that this must be a most excellent thermoscope, and must be admirably adapted to the delicacy which is necessary in experimenting in reference to heat. Provided, then, with this apparatus, Melloni set about examining accurately the relations of heat and light, a problem which philosophers have long been endeavouring to elucidate. For this purpose, he studied permeability of heat through different bodies. Mariotte concluded, from his experiments, that the heat of a common fire does not pass through glass, or at least, in very minute quantity. Scheele went further, and decided that not a ray of heat traversed glass. Pictet, however, repeated Scheele's experiment, and obtained a contrary result. From these observations, and those of Herschel, it was inferred that heat does not pass through diaphanous substances, with the exception of atmospheric air. Prevost and Delaroche, by ingenious adapta-

* Annales de Chimie, translated in Thomson's Records, No.

tions, proved, however, that heat is transmitted directly through glass, independent of its conducting power; and this fact has been allowed, with few exceptions, by all philosophers. But although this admission was made, the subject was involved in great obscurity, and presented an inviting field of inquiry to the ingenuity of Melloni. No examination had been instituted into the influence of the state of the surface, of the thickness of the substances through which the heat was transmitted, or of their internal structure upon permeating heat. These, however, were taken up by Melloni, and he is still engaged in the prosecution of his researches. It is easy to see how the different relative diathermal powers or capacities of bodies for transmitting heat could be determined by the apparatus of Melloni, for all that was required was to interpose the substance whose powers were to be investigated, between a steady heat and the voltaic pile, when their capacities would be indicated by the rapidity of the action upon the needle. That the heat is actually transmitted, and does not pass by conduction, is proved by the fact that the internal portions of the glass do not instantly become heated, which is demonstrated by placing a glass screen in front of the pile, and intercepting the communication with the source of heat. The posterior surface of the glass plate would radiate the heat conducted from its interior towards the pile, if the hypothesis that the heat is communicated by conduction were correct. But this does not occur, and hence, there is no alternative left but the conclusion that heat permeates bodies directly. Heat and light agree, therefore, in this property, that both possess the power of passing through bodies. It is proper that each should have such a capacity distinguished by appropriate names, until their identity be proved. Melloni terms the permeating power of heat through bodies, *diathermal* power, just as we indicate capacity of bodies to transmit light by the names, transparency, opalesence, &c. The diathermal power is subject to similar modifications. Heat, however, differs from light in this respect, that the facility with which it is transmitted by different bodies has no relation to their transparency.

Thus if we suppose the rays of a constant heat to be represented by 100, the only body which appears but slightly to diminish this when interposed as a screen is rock salt, whose diathermal capacity is 92, but the quantity of heat transmitted through a crystal of smoke-coloured quartz will be denoted by 57, and through a crystal of alum by 12, where the difference is so very great as to excite astonishment. This and similar facts have induced Melloni to conclude that heat and light are distinct; but in this opinion Dr. Faraday does not coincide.

Melloni has also examined the diathermal relation of colours, and has found that their powers are in the following order: violet 53, yellowish red 53, purple red 51, bright red 47, pale violet 45, orange red 44, clear blue 42, deep yellow 40, bright

yellow 34, golden yellow 33, dark blue 33, apple green 26, mineral green 23, very deep blue 19. Hence, we see that the mineral relations of the colours to their heating power is so completely altered, that the violet ray, which in the spectrum possesses temperature 25 or 30 times below that of the red ray, observes here a higher temperatue, but the result seems modified as occurs with light by the nature of the power employed, to illustrate the comparative experiments.

Dr. Faraday exhibited many of the experiments which Melloni has described in his papers, especially in reference to the diathermal properties of rock salt, glass, alum, with screens of which substances he had been supplied. The absorptive power of different colours, in relation to the solar spectrum was well illustrated by means of the oxyhydrogen blowpipe. The contrivance of passing the decomposed ray through a volume of disengaged ammonia had a happy effect, the colours of the spectrum being as it were made to float in the air.

He likewise exhibited the method of polarizing light by means of tourmaline, by which fanciful figures are formed, and light transmitted or withheld by merely altering the relative position of the screens properly adapted.*

CHEMICAL COMPOSITION OF BROTHS.

The erroneous notions entertained by many respecting the administration of soups and broths as articles of nourishment to invalids, may derive some corrections from such investigations as the following:—Five hundred grains of meat, deprived of bone, fat, and tendon, were put into a litre and half of distilled water, and gradually brought to the boiling point, and continued so for five hours, renewing the water as it evaporated. The decoction had the odour of soup, an agreeable taste, and yellowish colour, contained 12 parts in 1,000 of animal matters, and 3 parts in 1,000 of inorganic: spring water, containing sulphate and carbonate of lime, afforded a broth of less odour and inferior taste. When the meat was put into boiling water at once, the proportion of animal matter in solution was less, and the broth inferior to that obtained by heating gradually. The difference in flavour of broths appears to depend more upon the nature and proportions of the saline than the animal ingredients. In boiling meat in the usual manner, the albumen is partly dissolved before the temperature is raised to the degree at which it coagulates, when the remaining portion is partly coagulated, rises in scum, and partly dissolved in the water; the cellular membrane is partly dissolved, but some of it remains in a more or less indurated condition. The fibrine of the muscle is hardened, but none of it is dissolved, and if it was not for the cellular membrane, albumen, and oil between the fibres, would prove a refractory

* Thomson's Records, No. 3.

article of diet. The fat remains partly entangled in the meat and partly floats at top; the flavour of broths arises from it in a considerable degree: much change is effected by evaporation, decomposition, and new combinations during protracted boiling, the volatile parts upon which the flavour principally depends being dissipated. These experiments were instituted to determine the nature of the peculiarities of broths obtained from the dried extracts of meat called portable soups; and from the results, as well as from common experience, it may be inferred, that the most palatable and suitable broths or soups for convalescents requiring great care as to delicacy of diet, may be obtained by soaking the meat for some time at a low temperature, and setting aside the solution, to which should subsequently be added the stronger broth obtained by adding fresh water to the meat and continuing the boiling; or palatable broths may be made with little delay by macerating the meat for a short time in warm water, and adding jelly, previously prepared, in such quantity as may be advisable.*

HYDRATE OF IRON, AN ANTIDOTE FOR ARSENIOUS ACID.

DR. BUNSEN, of Gottingen, has proposed the hydrate of iron as an antidote in cases of poisoning by arsenious acid, for he finds that a solution of the acid is completely precipitated by the hydrous oxide. He has observed likewise that if the latter body is exposed to a gentle heat with arsenious acid in very fine powder, an arsenite of iron is formed. He has ascertained by experiments on dogs, that from two to four drachms of the oxide, mixed with sixteen drops of ammonia, are sufficient to convert eight or sixteen grains of arsenious acid into an insoluble arseniate.†

ATMOSPHERIC AIR.

ACCORDING to Berthollet, by the usual phosphorus eudiometer, the remaining azote is increased by the phosphorus vapour 1-40th of its volume. To satisfy himself upon this point, Brunner passed a quantity of atmospherical air from a gas holder, first through mercury and chloride of lime, and then through red hot iron filings. The gas thus freed from oxygen was placed over mercury, the temperature and pressure being noted. A stick of dry phosphorus was next allowed to remain for some time in the gas, but produced no change in its volume. Sometimes, after standing many days, a slight diminution took place, but never amounting to 1 per cent., which was ascribed to the admission of a small portion of oxygen.

* From a Report of M. Chevreul to the Royal Academy of Sciences, noticed in the Journal de Pharmacie; and translated in the Dublin Journal, No 23.

† Journal de Pharmacie.

Tralles, from theoretical views, calculated that the quantity of oxygen in atmospherical air diminishes with the height, and that at the surface of the sea, air contains

	21·00 per cent.	
1,000 feet above the sea	20·90	"
8,000 ditto - -	20 22	"

Saussure found the quantity less upon the hills than in the valleys, (1·25 less) by means of Priestley's eudiometer. Berger, with sulphuret of potassium, phosphorus, and nitrous oxide, estimated the proportion at between 20 and 21 per cent.

Configliachi observed that, with phosphorus, the proportion of oxygen was smaller below 50° than above 64½°.

The mean of 14 experiments by Brunner, gives for the proportion of oxygen in common air, determined by means of phosphorus, 20·915 per cent.

The smallest quantity obtained was 20·75, the temperature of the residual azote being 50° F., and the pressure 555·9 millimetres, and the greatest result was 21·11 when the thermometer was 53½ F., and the barometer at 556·0 mill. Both experiments were made about 7 A.M.*

ON THE EVOLUTION OF LIGHT DURING CRYSTALLIZATION.

By Henry Rose.†

An emission of light has often been noticed during crystallization, but its appearance has always been a casual one, and never, as far as I am aware of, has it been produced at will. I have observed during the crystallization of arsenious acid a strong emission of light, which differs from that seen during the crystallization of other substances, in as much as it may be produced at pleasure. Take two or three drachms of the transparent or vitreous arsenious acid, put it in a matrass of white glass along with an ounce and a half of not fuming muriatic acid of the common strength, and half an ounce of water; allow the whole to boil for ten minutes or a quarter of a hour, and then let it cool as slowly as possible, which is best done by gradually decreasing the flame of the spirit-lamp which had been used for the boiling. If the experiment is conducted in a dark room, the crystallization is accompanied by a strong emission of light, the formation of each little crystal being attended by a spark. If the vessel is then agitated, a great number of crystals suddenly shoot up, and an equal number of sparks occur at the same time. If a considerable quantity of arsenious acid, such as an ounce or an ounce and a half, or more, is treated with a corresponding quantity of diluted muriatic acid, then, on shaking the vessel, if the right moment be seized, the emission of light from the shooting of the crystals is so powerful that a dark room may be lighted up by it.

* Poggendorff's Annals.

† Read to the Academy of Sciences at Berlin, July 30, 1835.

Considerable time elapses before the acid solution of arsenious acid leaves off depositing crystals, consequently the cooled solution still continues to emit light on the second and even on the third evening, but only extremely feeble, and only when it is agitated. It is, however, impossible after this to produce any emission of light; a proof that it is occasioned by the shooting of the crystals, and not by electricity of friction.

If the hot solution of the transparent arsenious acid is allowed to cool rapidly, whereby a friable mass of arsenious acid is obtained, then either a very feeble light or none at all can be observed. Equally little light is observable if the transparent acid is treated with acetic or nitric acid, the latter either of the common strength or fuming. The reason of this is simply that these acids dissolve but very little of the arsenious acid, especially the acetic acid, so that this solution is but slightly tinged yellow by sulphuretted hydrogen, without any sulphuret of arsenic being precipitated. Dilute sulphuric acid, on the other hand, dissolves rather more arsenious acid by boiling, and if this solution be allowed to cool very slowly, a feeble light may sometimes be observed. If a large quantity of the transparent arsenious acid is treated with only so much nitro-muriatic acid (which, however, must contain an excess of muriatic acid,) that it is not completely dissolved and oxidized to arsenic acid, a strong light is then observed on cooling.

The cause of the luminosity of crystals during their formation has long appeared to me to be this: that the substance which separates from a fluid in the form of a luminous crystal is not contained as such in the solution, but that it is only formed when the crystal is formed, and that the appearance of light is necessarily conditioned by the formation of a new substance in a crystalline state.

The light evolved during the crystallization of substances has most frequently been observed with sulphate of potash, but always only casually, and never during the recrystallization of pure sulphate of potash, but, as I believe, merely during the crystallization of the solution of the residue from the preparation of nitric acid. This contains almost always sesquisulphate of potash, which as such is soluble in water, but which, according to Phillips, is decomposed whilst crystallizing into bisulphate and neutral sulphate of potash; and the latter becomes luminous during crystallization, whilst it is formed in the fluid, and crystallizing out of it.

Two isomeric states of the arsenious acid are commonly known: it is either transparent and vitreous, or porcellaneous and opake. At first after melting it is quite transparent, but simply by keeping it, and without its experiencing any increase of weight, it becomes milk-white and opake. In both states the acid has different specific gravity and solubility in water.

I have only been able to observe the evolution of strong light

during the crystallization of the arsenious acid, when I treated the vitreous acid with muriatic acid in the above-mentioned manner. In the same manner the opake acid and also the pulverulent arsenious acid, which is obtained by sublimation during the roasting of the arsenical ore, and which is known in commerce under the name of "Giftmehl,"* when treated with muriatic acid did not produce, even by the most gradual cooling, any light, and it was only by shaking the vessel that a very feeble light was visible; in the latter case most likely because the opake acid contained still some portions of the vitreous acid. But this feeble light could never be compared with the strong light which was visible when the transparent acid was employed. The light evolved during the shooting of the crystals of the arsenious acid appears, therefore, to depend upon this, that the solution of the transparent acid is changed by crystallizing into the opake or porcellaneous kind. The crystals produced belong, therefore, to the opake modification; and the change of the transparent into the opake acid is caused by nothing else than the transformation of the acid from a completely uncrystalline to a crystalline state.

The crystals of arsenious acid which are obtained from a very slowly cooled solution in muriatic acid are, however, transparent; but this transparency is caused only by their size, and an aggregate of very small crystals of the acid would exhibit an opake appearance. The crystals formed were always regular octohedrons, and did not possess the form observed by Wöhler, which is, perhaps, a third isomeric modification of arsenious acid.

If the transparent acid is treated in the above mentioned manner and proportions, and the crystals have been formed accompanied by phosphorescence, and the whole been allowed to cool perfectly, the phosphorescence can be obtained once more, and sometimes even very powerfully, if the whole is again heated to the boiling-point and slowly cooled. However, the light is much more feeble than that first observed, and is only caused by the muriatic solution still containing portions of the transparent arsenious acid, and which during crystallization evolves this feeble light. Moreover, the quantity of dilute muriatic acid in the mixture above-described is not sufficient to dissolve all the arsenious acid, and there remains, therefore, a small portion in the vitreous state.

But still all the appearances of light which have been observed cannot be explained on the principle of a new arrangement or formation, and I myself hold this hypothesis to be one which requires the evidence of more facts to establish its probability. Thus, Berzelius observed phosphorescence during the crystallization of fluoride of sodium out of a solution which held the same salt already in solution.

* The suboxide of arsenic of Berzelius.

TABLE OF THE SPECIFIC HEAT OF BODIES.

AVOGADRO has recently made experiments upon this interesting subject. The following table contains the results of these trials, with the numbers affixed by other experimenters.*

	Avogadro	
Carbon	0·257	0·25 Crawford
Protoxide of lead	0·050	0·049 Gadolin
Red oxide of mercury	0·050	0·501 Lavoisier and Laplace
Protoxide of tin	0·094	0·096 Crawford
Deutoxide of copper	0·146	0·227 Crawford
Oxide of zinc	0·141	0·137 Do.
Anhydrous lime	0·17	0·223 Crawford 0·217 Lav. and Laplace
Peroxide of iron	0·213	0·167 Gadolin
Red oxide of lead	0·072	0·068 Crawford and Kirwan 0·0[illegible] Gadolin 0·062 Lavoisier and Laplace
White oxide of arenic	0·141	
Alumina, anhydrous	0·200	0·185 Gadolin
Deutoxide of tin	0·111	0 096 Crawford
Peroxide of manganese	0·191	
Quartz	0·179	0·195 Crawford (agate)
Sulphuret of iron	0·135	
Sulphuret of lead	0·046	
Cinnabar	0·048	
Yellow sulphuret of arsenic	0·105	
Chloride of sodium	0·221	0·226
Chloride of potassium	0·184	
Chloride of lime	0·194	
Deutochloride of mercury	0·069	
Protochloride	0·041	
Red oxide of iron (hydrous)	0·188	
Alumina (hydrous)	0.420	
Lime (hydrous)	0·300	
Potash (hydrous)	0·358	
Carbonate of lime	0·203	0·256 Crawford 0 207 Gadolin
Carbonate of potash (anhydrous)	0·237	
Carbonate of soda (anhydrous)	0·306	
Sulphate of lime (anhydrous)	0·190	
Sulphate of potash	0·169	
Sulphate of soda (anhydrous)	0·263	
Sulphated protoxide of iron (anhydrous)	0·145	
Sulphate of copper (anhydrous)	0·180	
Sulphate of zinc (anhydrous)	0·213	
Nitrate of potash	0·269	
Nitrate of soda	0·240	
Sulphate of lime (hydrous)	0·302	

* Annales de Chimie, translated in Thomson's Records, No. 2.

PREPARATION OF PURE TELLURIUM. BY BERZELIUS.

Telluret of silver having lately been found in Siberia, and telluret of bismuth at Schemnitz, Berzelius has obtained the metal in a pure state from the former by the following process: Mix dry carbonate of potash intimately with the well-pulverized mineral, make it into a thick paste with olive oil, and put it into a porcelain crucible with a cover. The crucible is then to be at first gently heated, till the oil is carbonized; and when gas ceases to burn at the edges of the crucible, the heat is to be raised for a moment to whiteness, and the crucible then allowed to cool. A deep, brown, porous mass is obtained; it is to be quickly powdered in a dry mortar, and thrown upon a dry filter and washed with boiling distilled water, with as little contact of air as possible.

A liquor of a rich red colour is obtained, which whenever it comes into contact with the air, becomes of the lustre of silver from the tellurium which separates, while the potassium oxidizes by the oxygen of the air. As soon as the liquor passes colourless, the mass on the filter is sufficiently washed, and is composed of charcoal and metallic bismuth, containing mere traces of tellurium.

The deep red solution contains talluret of potassium mixed with more or less sulphuret and seleniuret of potassium, with a small quantity of telluret of gold, copper, manganese, and iron. If the solution be suffered to remain at rest, the surface becomes covered with a pellicle of tellurium, and gradually, but very slowly, it becomes turbid to the bottom: by blowing air into it the mass oxidizes readily. The potassium becomes potash, and the tellurium is precipitated in the metallic state; it may be said that the tellurium is precipitated by oxygen. When the precipitation has ceased, the solution assumes a green colour, and if it be poured off at this moment, it deposits in a few seconds a very small quantity of tellurium, and the liquor becomes yellow when the precipitation has ceased. The green colour is owing to a mixture of the blue tint occasioned by the small quantity of tellurium mixing with the yellow colour of the liqour. Sometimes the remaining liquor is of a dull rose colour, and gives no precipitate in several days; this is owing to the telluret of iron which it contains.

As long as the potash is in access, the sulphur and the selenium are not precipitated, but the access of air converts them into acids; this is a method of obtaining tellurium free from these substances. Muriatic acid precipitates from the yellow solution the selenium and the sulphuret of tellurium which it contains, in the state of sulphuret and seleniuret of tellurium.

The tellurium precipitated from the alkaline solution is a very fine and dense powder: it must be purified by distillation; but on account of its slight volatility it cannot be sublimed from a retort in a common furnace. In order to effect it, a long porclain

vessel, containing tellurium, was put into a large porcelain tube in a furnace; it was heated to redness, and a current of hydrogen gas passed over it. The tellurium was converted into vapour, and it was constantly carried by the hydrogen towards the cold parts of the tube, where it was condensed. In order to make the tellurium flow after its condensation, the tube must be slightly inclined. In a short time all the tellurium distils, and there remains in the porcelain vessel a small button formed of the tellurets of gold, copper, and iron, the product of the distillation is pure tellurium.

In general the process, which consists in fusion with potash and charcoal, may be employed to purify tellurium, especially if it contains sulphur, selenium, or arsenic, all bodies which cannot be separated from it by distillation. The arsenic goes off in vapour at a red heat, and the two others, after the precipitation of the tellurium by the air, remain dissolved in the liquor. The solution of potash contains the metals which render the tellurium impure. If in this operation powdered charcoal be employed instead of oil, the mixture may be strongly heated at once, but the solution of telluret of potassium which is then obtained contains telluret of calcium; and as the lime which is produced is precipitated with the metal, the precipitate must be first washed with muriatic acid, and then with water. The quantity of charcoal ought always to be sufficient to prevent the mass from fusing during reduction, for then it would go over the edges of the crucible and part of it would be lost.*

EXPERIMENTS TO ASCERTAIN THE EXISTENCE OF LEAD IN THE ATMOSPHERE OF A WHITE-LEAD MANUFACTORY.

Mr. Arthur Dunn, having witnessed at his manufactory in the City Road, the frightful effects of white-lead on the workmen employed, was anxious to determine if it was possible for lead to exist in the atmosphere, and through that medium be absorbed into the system by the action of the lungs. For this purpose he made the following experiment, which certainly is important to the manufacturer, as it points out a serious evil to be guarded against.

An evaporating dish, containing about 25lbs. of moist carbonate of lead, was placed in a sand-bath, and heated to about the same temperature as the drying stove commonly used, never exceeding 150° Fahr.: over this was fixed, at the distance of from eight to twelve inches, a pair of common bellows, with a glass tube attached to the pipe, which pipe was introduced into a green glass bottle containing 12 ounces of distilled water, acidulated with 2 drachms of nitric acid. The apparatus being thus arranged, the bellows were set in action, by which means the atmosphere, loaded with the moisture from the lead, was made to pass in a continued current through the liquid: this was

* Annales de Chimie.

continued for six hours. The whole was then transferred into a platina dish and evaporated to perfect dryness. The residue was dissolved in one ounce of distilled water with two drops of nitric acid to insure the solution of the lead should any be present. A current of sulphuretted hydrogen was next passed through the solution, which immediately gave a minute dark precipitate; this being collected on a filter and washed, was transferred to a watch-glass, and treated in the usual manner with nitric acid to decompose the sulphuret, which gave on the application of hydriodate of potash the most unequivocal proof of the presence of lead.

Another experiment was conducted at the same time with similar vessels in the same room, but the current of air was not passed through the liquid. This on the application of sulphuretted hydrogen gave not the least indication of lead, but, on evaporating the whole to dryness and treating the residue in the manner before described with hydriodate of potash, the slightest possible trace of the yellow iodide of lead was perceptible. The nitric acid and distilled water were separately tested with great care, but were found perfectly free from lead, so that no doubt the trace of lead must have been absorbed from the atmosphere, as the bottle containing it stood beside the one through which the current of air was passed. I ought to have mentioned before that the temperature of the laboratory during the experiment was from 70 to 80 Fahr., and that the door was kept closely shut that the air might be loaded as much as possible with the

OIL OF CINNAMON, &c.

MM. Dumas and Peligot observe that there occur in commerce several varieties of cinnamon and two of the oil, which are easily distinguished. That which comes from China is of a reddish brown colour, and its smell is disagreeable. The oil from Ceylon is sugary, and has a sweet smell; it is better than the former.

Not being able to rely upon the oil of cinnamon procured in commerce, MM. Dumas and Peligot prepared it by distilling it from the bark. In order to obtain the pure oil, the bark must be bruised, and left twelve hours digesting in a saturated solution of salt, and then subjected to rapid distillation over a naked fire. The water is milky, and allows the oil to deposit; and the water suffered to remain in contact with the air becomes filled with lamellar and acicular crystals.

When oil of cinnamon is treated with concentrated nitric acid, it almost immediately concretes, and forms a true crystallized salt, in which the oil serves as a base. This characteristic phenomenon is very imperfectly produced in the oil of commerce from China and Ceylon,* requiring from eight to twelve hours for producing the effect; and while the pure oil is converted

* Philosophical Magazine, No. 37.

into a hard, friable, colourless, crystalline mass, the oils of commerce always give a butyraceous product, the crystals of which are evidently mixed with a deep-coloured oleaginous substance, the nature of which is unknown. Oil of cinnamon combines with dry gaseous muriatic acid. The purest becomes of a deep green tint; it forms a crystallizable product with ammonia, unchangeable when exposed to the air.

Oxygen gas is rapidly absorbed by oil of cinnamon, especially when it is humid; it forms in this way a new acid, which the authors call *cinnamonic acid;* it appears to be similar to that produced in old oil of cinnamon, or in cinnamon water exposed to the air.

When oil of cinnamon is treated with hot nitric acid, a strong smell of bitter almonds is produced, and when the action of the acid is over, a great quantity of benzoic acid is found in the residue. If oil of cinnamon is boiled with a solution of chloride of lime, there is also found a quantity of benzoic acid, or rather of benzoate of lime. The action of chlorine on this oil presents some phenomena of great interest; the chlorine acts at first in forming a chloride of benzoyle; but when its action, aided by heat, is over, a very stable crystalline compound is procured, in constitution approximating to a chlorate.

Oil of cinnamon appears as a substance which acts the part of a base. It combines with acids: and MM. Dumas and Peligot do not think that the action of ammonia upon it is of such a nature as to modify the conclusions drawn from the action of acids. The oil prepared as above gave by analysis:*

C 36	1377·3	82·1
H 16	100·0	5·9
O 2	200·0	12·0
	1677·3	100·0

MODE OF DETECTING SOME ORGANIC ACIDS.

By Henry Rose.

Tartaric, racemic, citric, and malic acids may be readily detected in the following manner: dissolve them in as small a quantity of water as possible, and add to the solution an excess of lime water, so that reddened litmus paper may become blue.

Tartaric and racemic acids form a precipitate in the cold state. That produced by the tartaric acid dissolves completely in a small quantity of a solution of ammonia, while that of the racemic acid remains insoluble. Both acids can likewise be readily distinguished by their treatment with a solution of sulphate of lime, when after some time racemate of lime is deposited, while the solution of tartaric acid is not affected.

The solution of citric acid yields no precipitate with lime water in the cold state, but when heated, a considerable precipitation

* Journal de Chimie Médicale.

occurs. If a small quantity of a very dilute solution of citric acid is mixed with lime water, a precipitate falls by boiling, which is taken up by allowing the solution to cool. The solution of malic acid occasions no precipitate with lime water, either in the cold or by boiling. For these experiments completely saturated lime water should be employed.*

EFFECT OF GASES ON VEGETATION.

By M. Macaire.

M. Macaire introduced some plants of Euphorbia, Mercurialis, Senecio, Sonchus, &c. into vessels along with chloride of lime in the morning. When evening arrived the plants had not suffered, and the odour of the chlorine was as strong as at first. Next morning they were found withered, the smell of chlorine had disappeared, and was replaced by a very disagreeable acid odour. The same result was obtained on repeating the experiment several times.

Nitric acid withered the plants during the night, but in the day time merely rendered some of them brown coloured.

Sulphuretted hydrogen produced no alteration when light was present, but destroyed them in the night, by the absorption of the gas.

Muriatic acid gas acted in a similar manner.†

ECONOMICAL MEANS OF OBTAINING THE SALTS OF MANGANESE IN A STATE OF PURITY.

By Thomas Everitt, Esq., Professor of Chemistry to the Medico-Botanical Society.

Having had occasion for some pounds of pure salts of manganese for experiments on dyeing, my attention was turned to consider the convenience and economy of these processes prescribed in our systematic works. The process of Faraday by hydrochlorate of ammonia, is easy of execution, and perfect as to the results, but expensive; that of Turner, "by mixing the oxide left after procuring oxygen gas by heat, with one-sixth of charcoal, and exposing to a white heat for half an hour in a covered crucible, dissolving in hydrochloric acid, evaporating to dryness, and keeping the mass in perfect fusion for a quarter of an hour," &c. yields also good results, but is tedious in the execution, and expensive, if time and trouble be considered; moreover, by the first ignition, although we subsequently save a little hydrochloric acid (none being lost as chlorine) by reducing the manganese to protoxide, we also at the same time render the iron in such a state that on dissolving in hydrochloric acid we have a protoxide, which is more difficult to get quit of by the second ignition than it would have been as a peroxide.

* Poggendorff's Annalen. xxxi.

† Annales des Sciences Naturelles.

As I possessed a large quantity of hydrochlorate of manganese and iron, the accumulated solutions from preparing chlorine by hydrochloric acid and ordinary oxide of manganese, I was induced to make a variety of trials on this liquid with the view of separating the iron from the manganese, the results of which were entirely satisfactory.

Method, No. 1.—*Depending on the circumstance that when a solution of hydrochlorate of iron, strictly peroxide (which is always the case in the above liquid), is evaporated to dryness, and the heat afterwards slightly elevated, a small portion sublimes as perchloride, the rest is decomposed into free hydrochloric acid and peroxide which remains behind.*

The clear decanted or filtered liquid, generally acid of a dark colour, is to be evaporated to dryness in a porcelain dish, when a mass of small bright crystals will be obtained. The heat of the sand-bath is now to be considerably increased, when, by constantly stirring the mass taking care to heat the sides as well as the bottom of the dish, it soon acquires a grey ashy aspect; and if the operation be continued till hydrochloric acid gas ceases to rise (this to be ascertained by holding a rod dipped in ammonia over it), we obtain, on pouring water on it and filtering, a colourless liquid, containing all the hydrochlorate of manganese and no iron, since it will be found to give a white precipitate with yellow ferro-prussiate of potassa, having no blue tinge. This latter part of the process may be conducted with much greater dispatch by putting the dry yellow salt into an ordinary iron ladle, and stirring with an iron rod over a slow fire till it becomes ash-grey, or till all hydrochloric acid fumes cease to rise. The heat never requires to be raised near redness so as to fuse the mass; for small quantities this part of the operation may be performed in a platina crucible.

Having a pure hydrochlorate, of course all the other salts can be obtained: the carbonate by precipitation with carbonate of soda, filtering, washing, &c., and from it any salt or preparation required by the scientific chemist.

Should the manganese ore have originally contained barytes, or lime, these must be removed from the solution before precipitating the carbonate of manganese, the first by a little sulphate of soda, the second by a little oxalate of ammonia; this, however, does not remove the last traces of lime—(*according to Turner*).

Method, No. 2.—*Depending on the circumstance that carbonate of manganese will precipitate peroxide of iron when boiled in a solution of any peroxide salt of this metal.*

Add to the filtered solution of hydrochlorate of peroxide of iron and manganese, a small quantity of carbonate of soda, so as to precipitate a small portion only of peroxide of iron and carbonate of manganese: now boil for five or ten minutes, when the carbonate of manganese will be re-dissolved, throwing down and replacing the peroxide of iron. If, on filtering a minute quantity of the solution, some iron is still found to be present, by its yielding with yellow ferro-prussiate of potassa a precipitate tinged with blue, a little more carbonate of soda is to be added, and the liquid boiled again: a very little experience will enable the operator by this means to free the solution entirely from iron, and at the same time to have a very small portion of carbonate of manganese remaining with the precipitated peroxide of iron. The filtered solution will now contain nothing but hydrochlorate of soda and hyrochlorate of

manganese, and from it the pure carbonate of manganese may be obtained as before.

A slight modification of this process may be made if we require at once a pure hydrochlorate of manganese free from all salts of soda or potassa. Add to the compound solution, freed from excess of acid by partial evaporation and re-solution, some carbonate of manganese, enough to replace the peroxide of iron; boil for some time, filter, &c.: or, if the operator have no carbonate of manganese, take a portion of the liquid apart, precipitate by carbonate of soda all the iron and manganese, and wash well; then remove the still wet mass from the filter, consisting of carbonate of manganese and peroxide of iron, add this to the remaining liquid and boil, when, as before, the rest of the iron will be precipitated and replaced by the manganese. Of course the portion of liquid which must be precipitated apart depends upon the relative quantities of iron and manganese in the solution, and on the quantity of free acid: in my experiments 1-20th of the solution was sufficient to furnish enough of the precipitate to effect the entire purification of the remaining 19-20th; but I had removed nearly all excess of acid by evaporation.

This process is peculiarly adapted to the purification of a solution of hydrochlorate of manganese containing only a trace of iron, saving thereby the trouble of evaporating the whole of the liquid and igniting: thus I found in one of my trials that I had four pints of a strong solution of hydrochlorate of manganese containing only a trace of iron; the evaporation of all this to dryness and igniting would (seeing it contained more than a pound of hydrochlorate of maganese) have been a very long and tedious operation, but by adding a few grains of carbonate of manganese, and boiling for a quarter of an hour, it became quite pure.

It must be borne in mind that the success of these methods depends entirely on the iron being strictly peroxide: should any protoxide be present, this must be peroxized by the addition of nitric acid.

I find that carbonate of manganese free from iron can also be procured from the liquid obtained, on dissolving the mass left after procuring chlorine by common salt, oxide of manganese, and sulphuric acid,—by the method, No. 2.

Hence, the dyer, potter, or glass-maker, can now have, at a trifling expense, all the preparations of manganese chemically pure, and the absence of iron is of much importance in many of their applications in the arts.*

COBALT BLUE COLOURS.

M. Gaudin gives the following processes for preparing blue colours from oxide of cobalt:—

Prepare borate of cobalt by adding a neutral salt of cobalt to one of borate of soda; wash the precipitate slightly, and calcine it also slightly. Mix one part of this borate of cobalt with one or two parts of fused phosphate of soda, and heat the mixture to redness in a crucible. Phosphate of cobalt may be used instead of the borate, and a fine blue will be obtained. The phosphate of soda may be replaced by the arseniate.

* Repertory, No. 17.

Borate of cobalt may be prepared as follows:—Add an excess of borate of soda to a solution of a salt of cobalt, and a solution of carbonate of potash or soda, as long as a precipitate is formed. Wash, filter, and calcine slightly. Another blue may be formed by mixing twelve parts of phosphate of cobalt slightly calcined, twelve parts of fused phosphate of soda, two parts of fused borax, four parts of calcined alumina; and there may be added, if preferred, three parts of calcined carbonate of soda. Mix them intimately in a mortar, and heat to redness in a crucible. By this process a very fine blue is obtained.*

ERUPTION OF VESUVIUS.

On March 19, a paper was read, at the Royal Society, entitled, "Some Account of the Eruption of Vesuvius, which occurred in the month of August, 1834, extracted from the manuscript notes of the Cavaliere Monticelli, Foreign Associate of the Geological Society, and from other sources; together with a Statement of the Products of the Eruption, and of the Condition of the Volcano subsequently to it." By Professor Daubeny, F.R.S., F.G.S., of Oxford.

It appears, from the information collected by the author, that for a considerable time previously to the late eruption of Vesuvius, stones and scoriæ had been thrown up from the crater, and had accumulated into two conical masses, the largest of which was more than two hundred feet in height. On the night of the 24th of August, after the flow of considerable currents of lava, a violent concussion took place, followed by the disappearance of both these conical hillocks, which in the course of a single night, were apparently swallowed up within the cavities of the mountain. Fresh currents of lava continued to flow for several days subsequently, destroying about 180 houses, spreading devastation over a large tract of country, and destroying all the fish in the neighbouring ponds and lakes. After the 29th of August, no further signs of internal commotion were manifested, with the exception of the disengagement of aqueous and aëriform vapours from the crater, a phenomenon which in a greater or less degree, is at all times observable. The author descended twice into the interior of the crator, which then presented a comparatively level surface; its sides consisting of strata of loose volcanic sand and rapilli, coated with saline incrustations of common salt, coloured red and yellow by peroxide of iron. The vapours which issued from various parts of the surface, collected and condensed by means of an alembic introduced into the ground, were found to consist principally of steam and muriatic acid, with only a slight trace of sulphureous or sulphuric acids. From a trial with solution of barytes, the author concludes that carbonic acid was also exhaled, but neither nitrogen nor sulphuretted hydrogen appeared to form any

* Journal de Pharmacie, quoted in the Philosophical Magazine, No. 32.

part of the gas emitted. The steam issuing from the lava contained both free muratic acid and also muriate of ammonia, which latter salt could not be detected in the gas from the volcano itself. The author conceives that these volatile principles are entangled in the lava, and are subsequently disengaged.*

PETROLEUM AND NAPHTHA.

On Dec. 15, 1834, was read before the Royal Society of Edinburgh, a paper on the composition of the Rangoon Petroleum, with Remarks on the composition of Petroleum and Naphtha in general. By William Gregory, M.D., F.R.S.E.

The author first adverted to the discovery, nearly about the same time, of paraffine by Reichenbach and of petroline by Dr. Christison. The former occurred among the products of destructive distillation; the latter was found in the Rangoon petroleum, and they were soon found to be identical. Reichenbach's researches on naphtha were then quoted, by which it appears that that indefatigable observer could not discover, in the kind of naphtha which he examined, any trace either of paraffine, or of any other product of destructive distillation. On the contrary, he found that naphtha to possess the characters of oil of turpentine, a product of vegetable life; and he succeeded in obtaining a precisely similar oil from brown coal by distillation at 212°. These facts had led Reichenbach to the conclusion that naphtha in general is not a product of destructive distillation, and, consequently, must have been separated at a comparatively low temperature. The author showed that Dr. Christison's discovery of paraffine, of which Dr. Reichenbach was necessarily ignorant, is inconsistent with this view; and detailed some experiments, by which he has rendered highly probable the existence in petroleum of eupion, another of the products of destructive distillation. This substance is a liquid of sp. gr. 0·655, boiling at 110°, and very fragrant. The author obtained from the Rangoon petroleum a liquid of sp. gr. 0·744, boiling at 180°, and rather fragrant. The oil of turpentine, as is well known, boils at 280, and has a sp. gr. of 0·860; so that, at all events, the naphtha from the Rangoon petroleum is not oil of turpentine. This was farther proved by the tests of nitric acid and iodine. Similar experiments on one or two other species of naphtha led to similar results. They all yielded a liquid of sp. gr. about 760, and, consequently, could not be oil of turpentine. The kinds of naphtha tried were Persian naphtha, obtained from Dr. Thomson, and commercial naphtha, sold by M. Robiquet of Paris.

The author concluded, that if the naphtha examined by Reichenbach were genuine, there must be at least two kinds of naphtha; one a product of destructive distillation, the other the oil of turpentine of the pine forests of which our coal-beds are

* Philosophical Magazine, No. 35.

formed, separated by a gentle heat, either before or after their conversion into coal. It is obvious that our common coal-beds have never yet been exposed to a heat sufficient for destructive distillation, since they are destroyed by a moderate heat, and we may therefore expect the petroleum of these coal-beds to be of the kind described by Reichenbach; while the Rangoon and Persian petroleums, being products of destructive distillation, must have their origin, if in coal-beds at all, in such as have been exposed to a high temperature, and must, consequently, be very different from the ordinary coal-beds. In confirmation of this view it may be stated, that Dr. Christison, could find no paraffine either in the petroleum of St. Catherine's or in that of Trinidad or Rochdale.

The author finally directed attention to the application of the paraffine as a material for giving light, as, when pure, it burns with a clear bright flame, like that of wax, and might doubtless be obtained at a cheap rate in the East.*

COAL-TAR GAS.

We have to congratulate the country on a discovery, by means of which that superabundant refuse, coal-tar, will be extensively used in the production of a splendid light. This invention occurred to Mr. Beale, during his experiments to render the spirit obtained from caoutchouc available for domestic and public lighting.

The coal-tar is not very inflammable; but, when lighted, produces in burning a dull sort of "darkness visible" flame, and abundance of murky smoke. For the new lamp there is a small circular trough, like a tea-cup, with a tube through it, and the tar is supplied to this vessel from a close tin canister, as it is consumed in burning. After the tar is lighted, the circular tar-trough is covered by another cup, which exactly fits on the outer rim of it, and would act as an extinguisher; but that there is a hole through the bottom of this cover, from which a short length of conical pipe descends about an inch, and up this pipe the smoke of the burning tar has to ascend; but this smoke is entirely consumed, and made to produce a most brilliant flame by a jet of air, which is forced up a very small pipe, rising through the hole in the centre of the tar-trough: the orifice of which air-pipe is a little above the level of the burning tar. The jet of air is regulated by a small cock, and the most surprising thing is the small supply of air which is found requisite to produce this large and vivid light, and to consume the smoke so perfectly that there is no smell from it. The lamp can be so easily seen at the factory of Mr. Beale, that we do not think it necessary to

* Jameson's Journal, No. 36.

explain the mode of suspending or regulating the supply of tar, or the relative size of the different parts.

The flame rises about six inches above the top of the inverted cup, and is more brilliant than a gas-light. We conceive that it will be very beneficial to the poor, for such a flame would be quite sufficient to boil a saucepan or tea-kettle, and for two-thirds of the year would render fire unnecessary in a cottage. It is calculated that one-horse power applied to an air-pump or bellows, would produce sufficient blast of air for the supply of two or three thousand lamps; but in detached cottages, a small bellows worked by the foot, or by a child, would supply the air necessary. A quart of coal tar, of the value of three-halfpence, will maintain this light in full brillancy for eight hours. We also think that the light is very applicable to light-houses, for which its brilliancy renders it particularly eligible. A large aerometer might be filled in the course of the day by the attendants on the light-house, on those rare occasions when there was not wind for working a small wind-mill, with which the light-house, where it is adopted, would of course be supplied; and the apparatus is altogether so simple, that we consider it quite as secure as the argand-lamp, over which it has great advantage in economy, but infinitely greater in the intensity of its light. Upon the whole, we consider this to be one of the most important economic and useful discoveries of the time.*

OIL EXTRACTED FROM THE SPIRIT OF WINE OF POTATOES.

By M. J. Dumas.

PREVIOUS to rectification, spirit of wine whether it be obtained from malt or potatoes, possesses a peculiar taste and smell which is removed by distillation frequently repeated. It has been long known that these properties depend on a peculiar oil, and its presence was first detected by Scheele. Fourcroy and Vauquelin proved that the oil was not a product of fermentation, but that it existed in grain and could be separated by treating it with water, and taking up the oil from the liquid by alcohol. M. Payen has shown that the seat of this oil is in tegumentary part of the fecula of potatoes. Those who have examined the oil proceeding from the spirit of barley, describe it as capable of crystallization, volatilizing with difficulty, undergoing alterations by distillation, and staining paper permanently. Pelletan found on the contrary, the oil from the spirit of potatoes to be a true essential oil. Dumas examined a specimen from the manufactory of Dubrunfaut; it possessed a reddish yellow colour, and a very disagreeable smell. When one breathes the air charged with it, nausea and head-ache are produced. Carbonate of potash diminishes the odour considerably, and when distilled with

* Literary Gazette, No. 952.

it renders it analogous to that of nitric ether. In order to free it entirely from alcohol, it is necessary to distil cautiously, and obtain a residue of pure oil boiling at 130° (266° F.) or 132° (269°) the alcohol passing over first. Dumas suggests that although bearing some affinity to alcohol and ether, it may belong to the family of camphors. The density of its vapour is 3·147, or calculating from the composition 3·072. It consists of:

Carbon . . .	68·6
Hydrogen . . .	13·6
Oxygen . . .	17·8*

PATENT AXLE-GREASE.

Mr. Henry Booth, of Liverpool, has patented the following axle-grease and lubricating-fluid, or chemical compounds of oil, tallow, or other grease, and water, effected by means of the admixture of soda or other alkaline substance, in such proportions that the compounds shall not be of a caustic or corrosive nature when applied to iron or steel, but of an unctuous greasy quality, easily fusible with heat, and suitable for greasing the axle-bearings of carriage-wheels, or the axles, spindles, and bearings of machinery in general. The proportions of the ingredients for the said compounds and the method of compounding them recommended as suitable for the above purposes, are as follow:—

For the axle-grease suitable for carriage-axles, and paticularly for the axles of every description of railway carriages, a solution of soda in water (the common washing soda of the shops) in the proportion of half a pound weight of soda to a gallon of pure water; to one gallon of this solution add three pounds of good clean tallow and six pounds of palm-oil; or, instead of the mixture of tallow and palm-oil, add ten pounds of palm-oil, or eight pounds of tallow (the tallow being of a stiffer nature than palm-oil.) The tallow and palm oil, or either of them, and the solution, as described, must be heated together, in some convenient vessel, to about 200° or 210° of Fahrenheit, and then the whole mass must be well mixed and stirred up together, and be agitated without ceasing till the composition be cooled down to 60° or 70° of Fahrenheit, and have obtained its consistency, which will be that of grease or butter, in which state it will be ready for use, and may be applied in the way in which grease is usually applied to machinery.

For the lubricating-fluid, which, also, is applicable to the rubbing parts of machinery (and particularly to the spindles of pulleys on inclined planes moving on wooden bearings) it is recommended to take of the aforesaid solution of soda in water, one gallon; of rape-oil, one gallon; and of tallow or palm-oil,

* Ann. de Chimie, lvi. 314.

one quarter of a pound weight: heat them together to 200° or 210° of Fahrenheit, and then let the fluid composition be well stirred about and agitated without intermission till cooled down to 60° or 70°, when it will be of the consistency of cream: or if a thicker consistency be desired, a small addition to the tallow or palm-oil may be admitted; and in all cases it is advantageous to shake or stir up the mixture immediately before using it.*

POISONS OF JAVA.

THE interest attached to the history of the *Bohun Upas*, or Poison Tree of Java, renders it important here to guard the student from a misapprehension respecting the substance in which its poisonous activity resides, which might arise from the manner in which the subject has been noticed alike by Dr. Henry, Mr. Brande, and Dr. Turner, when treating of the vegeto-alkalies, in their respective elementary works on chemistry. The original source of error is the confusion which exists in the popular knowledge of the two Javanese poisons, or rather its defficiency with respect to one of them. *Upas* simply means *poison;* and it is applied by the Javanese to two vegetable poisons, the *Upas antschar*, or *Bohun Upas*, derived from a tree, and the *Upas tshettik*, derived from a creeping shrub belonging to the genus *Strychnos*. But the word *Upas* in its popular reception in Europe is always taken to mean the *Bohun Upas*, respecting which so many marvellous relations have been promulgated; and hence, whenever that word is used, even when denoting in reality the *Tshettik*, it is supposed to refer to the first-mentioned poison. Pelletier and Caventou examined both these poisons, the former under the name of *Upas anthiar*, the latter under that of *Upas tieute;* and as stated above, the activity of the former was found by them to reside in a peculiar vegeto-alkali, and that of the latter in *strychnia* itself. But Dr. Henry (*Elements*, vol. ii. p. 329) confounds the *Tshettik* with the *Bohun Upas*, when he states that strychnia appears, "from the experiments of Pelletier and Caventou, to be separable, in a remarkably pure state, from the poison of the Upas tree." Mr. Brande appears to do the same, when he remarks (*Manual*, vol. ii. p. 539) that "the poison of the Upas tree" and the *woorara* "affords a vegeto-alkaline base resembling strychnia;" for he must really mean, agreeably to the explanation just given, not the Upas tree, or *Bohun Upas*, but the Tshettik, or *Upas tieute:* while the statement is likely to mislead in other respects, for the *Tshettik* affords strychnia itself, while the vegeto-alkali of the *woorara* is a distinct substance, resembling strychnia in some respects, but differing from it in others. Dr. Turner, by stating (*Elements*, p. 712) that Pelletier and Caventou have extracted strychnia "from

* Repertory, No. 21.

the Upas," contributes to perpetuate the error,—as this remark, though not incorrect in itself (since the term *Upas* is applicable to both poisons,) will be taken by most readers as alluding to the *Bohun Upas* alone, which, as we have seen, does not contain strychnia; while as the *Tshettik* is not popularly known as a kind of *Upas*, it will be lost sight of altogether. In order to preclude errors of this kind, it would be desirable, in elementary works on chemistry and natural history, to confine the use of the term *Upas* to the *Upas antshar*, and always to prefix to it the word *Bohun* (signifying *tree*), which would denote it to refer to the well known poison, of which *Bohun Upas* has become in Europe the popular name; and it would also be useful to notice particularly the existence of the more virulent *Tshettik*, which is at present scarcely known, except to those persons who are conversant with the natural history of Java.*

BLACK MUD FROM COMMON SEWERS.

At the time when cholera was prevalent in the south of France, it was deemed expedient to cleanse the common sewers of the town of Nancy. Braconnot took advantage of the opportunity to examine the mud derived from them. With dilute muriatic acid, a lively effervescence was produced, and carbonic acid and sulphuretted hydrogen were disengaged. The supernatant liquor contained iron and lime in solution. Hence, the colouring matter of the mud appears to have been sulphuret of iron, the the composition of which seems proportional to the peroxide of the metal. The sulphuret of iron, which forms the colouring matter, is obviously derived from the contact of sulphuretted hydrogen, produced by the decomposition of organic substances, with the peroxide of iron contained in the earth; most substances, it should be observed, which were extracted from the sewer, such as bones, wood, calcareous stones, were penetrated by the sulphuret of iron, which gave them a deep black colour. No crystallized pyrites were, however, observed. He conceives that the wood found in marshes, ditches, &c., possessing a dark colour, owes this tinge to the action of sulphuret of iron.

The mud of sewers, when boiled with water, scarcely colours it: and, by the evaporation of the filtered liquid, a small quantity of animal matter remains, which is yellow, inodorous, easily soluble in a little cold water, from which it is precipitated white, by the infusion of nut-galls, and by nitrate of silver; and, after combustion, affords some traces of muriate of soda.

The thin portion of the mud afforded no ammonia by caustic potash. The filtered liquid was brown. A drop of it placed on silver produced a black mark of sulphuret of silver. An acid

* Brayley's New Edition of Parkes's Chemical Catechism.

dropped into this liquid occasioned the disengagement of sulphuretted hydrogen, and a yellow flocky precipitation of animal matter. When well washed it acted on turnsol paper, and saturated alkalies.

Caustic ammonia takes up a brown matter, soluble in cold water, and reddening turnsol. The same substance, precipitated from its alkaline solution by an acid, is scarcely soluble in cold water, although it communicates to it a brownish colour.

By distillation much empyreumatic oil is obtained, as well as ammonia and sulphur, while charcoal remains, which, after combustion, leaves a quantity of oxide of iron.*

ELECTRICITY OF THE TORPEDO.

In the *Philosophical Transactions* for 1834, part ii., Dr. Davy's paper on the Torpedo *oculata and diversicolor*, termed indiscriminately by the Maltese, *Haddayla*, contains some experiments on the electricity of these species of animals, which establish the anticipation of Faraday, that by the application of Harris's electrometer to the torpedo, the evolution of heat would be observed. In his experiments detailed in a former volume of the *Transactions*, it was demonstrated that the electricity of the torpedo is capable of acting like voltaic electricity in effecting chemical decompositions. He enumerates at present all the tests or indications of the electricity of the torpedo now known, which are: 1st, the philosophical effect, as the sensation it imparts is sometimes called: 2nd, the chemical effects, as the precipitation of iodine, the decomposition of water, &c.: 3rd, its effect on the thermometer, galvanometer, and on steel in the spiral. These tests are, in point of delicacy, in the order in which they are enumerated. Dr. Davy has been unsuccessful in his attempts to elicit a spark from the torpedo, although it has been said that a spark has been obtained from the *Gymnotus electricus*.

With regard to the seat of the electrical power, it appears that when the brain has been divided longitudinally, the fish has continued to give shocks. When the brain was completely removed the fish instantly lost this power. Humboldt stated that a shock may be procured by touching only one surface of the fish, but Davy finds that it is necessary to touch the opposite surfaces of the electrical organs, or a conductor or conductors connected with them, before a shock can be received. On some occasions a shock was received when only one surface was apparently touched, but in that case the discharge probably took place through the water, and when one surface is touched, the animal instinctively makes an effort to bring the other surface in contact with the offending body.

* Annales de Chimie, quoted in Thomson's Records, No. 10.

There appears, however, to be no connexion between the muscular and electrical power. Two views may be taken of the phenomenon. It may be considered either, 1st, a form or variety of common electricity: or 2nd, a distinct kind; or 3rd, not a single power, but a combination of many powers. The first opinion is supported by Dr. Faraday. The only objection to it is the interruption of the torpedinal electricity by the smallest quantity of air, and its want of the power and attraction of the air, which affords some foundation for the second idea.

The origin of the electricity of the fish may also be urged as an argument for its specific nature, but without much plausibility, because, we are ignorant of its cause and nature. The third opinion may serve as a guide for more minute investigation. The author suggests that other varieties of electricity may owe their effects to the union of several powers, or ethereal fluids, and their peculiarities to the predominance, in various degrees, of these fluids. Dr. Davy found the skin covering the electrical organs, deeper coloured and thicker than below, more vascular, with stronger muscles, and more mucus, the under surface having a greater supply of cutaneous nerves, and a blood-vessel enlarged into a little bulb, situated one on each side of the porta, below the plexus of nerves supplying the pectoral fin, the use of which may be to propel the blood into the pectoral fin and electrical organ.*

DURATION OF ELECTRIC LIGHT.

The only remaining paper connected with electricity, in the portion of the *Philosophical Transactions* last quoted, consists of an account of experiments by Mr. Wheatstone, on the velocity and duration of electric light. In 1717, Dr. Watson found discharges through a circuit of four miles in extent, two miles through wire and two through the ground, to be apparently simultaneous. Mr. Wheatstone repeated a similar experiment, substituting for the imperfect judgment of the eye, a revolving mirror. This instrument revolved 800 times in a second, and during this time the image of a stationary point would describe 1,600 circles; the elongation of a spark through half a degree, a quantity obviously visible, and equal to one inch seen at the distance of 10 feet, would therefore indicate that it exists the 1,152,000th part of a second. The deviation of half a degree between the two extreme sparks, the wire being half a mile in length, would indicate a velocity of 576,000 miles in a second. This estimation is on the supposition that the electricity passes from one end of the wire to the other: if, however, the two fluids in one theory, or the disturbances of equilibrium in the other, travel simultaneously from the two ends of the wire, the velocity

* Thomson's Records, No. 4.

measured will be half that in the former case, or 288,000 miles in a second. The greatest elongation of the sparks was 24°, indicating a duration of about the 24,000th part of a second. The general conclusions which the author draws from his experiments are, 1st, The velocity of electricity through a copper wire exceeds that of light through the planetary space. 2nd, The disturbance of electric equilibrium, in a wire communicating at its extremities with two coatings of a charged jar, travels with equal velocity from the two ends of the wire, and occurs latest in the middle of the circuit. 3rd, The light of electricity in a state of high tension, has a less duration than the millionth part of a second. 4th, The eye is capable of perceiving objects distinctly which are presented to it during the same small interval of time.*

SPONTANEOUS COMBUSTION.

By M. Scanlan, Esq.

On May 25, Mr. M. Scanlan, detailed before the Royal Irish Academy, the following instances of Spontaneous Combustion :—

In the beginning of last March, a fire broke out in the extensive turpentine distillery on Sir John Rogerson's quay, belonging to Mr. John Fish Murphy, which is separated from my chemical factory by Windmill Lane. The fire, which was speedily got under, was confined to a heap of what is termed, by turpentine distillers, chip cake, and, from the circumstances under which it occurred, could not be attributed to any other cause than the act of an incendiary, or to the spontaneous ignition of this chip cake

As spontaneous combustion of this substance had never occurred before in Mr. Murphy's distillery, nor in that of his father, an extensive distiller of turpentine, for many years, at Stratford in Essex, I, at first, doubted that the fire could have originated in this way; however, on inquiry, I found his mode of working had been, on this particular occasion, different from that usually employed in his distillery, and, experiments which he kindly permitted me to make, have since proved beyond doubt that combustion did take place spontaneously.

Raw turpentine, as it comes from America, in barrels, includes a considerable quantity of impurity, consisting of chips of wood, leaves, and leaf stalks † It was hitherto the practice,

* Records of General Science, No. 4.

† The following extract from the letter of a French turpentine merchant, will account for the presence of these foreign bodies. To obtain the turpentine "the fir timber is chopped about a man's height down its side with an axe, not hand deep, and afterwards higher up. The turpentine or *rosin pat* is scraped up from the foot of the tree. That which is on the side-wound, when scraped off, is white, and called *galley pot*, of which the burning incense is made. It does not yield so much turpentine spirit as the *pat*."

in Mr. Murphy's distillery, as it is in England to heat the raw turpentine up to a temperature of about 180°, as I found by plunging a thermometer into one of his large copper, pans, and to strain the turpentine, thus liquified, from the impurities, previously to introducing it into the still, where it is submitted to distillation in the usual way, with a portion of water, yielding turpentine oil, which distils over along with the water and rosin which remains behind in the still. The chips, when separated by a wire strainer, still retain a quantity of adhering turpentine worth saving, and with this view are transferred to a large close vat, where they are exposed for some time to the action of steam furnished by a boiler kept for this purpose, as well as for steaming the empty barrels, in order to remove any turpentine that may adhere to them. Still, however, the chips are a good deal imbued with resinous matter, and in this state form a loose porous mass, which the turpentine distiller calls chip cake, a material which is used by the poor in the neighbourhood as fuel.

As long as the process I have just described was pursued, which is the London mode, and that which produces the best rosin, no accident occurred from fire in Mr. Murphy's premises, although I have frequently seen immense heaps of this chip cake collected together in his yard; but, on making trial of a different plan, namely, that practised by a Dublin distiller, Mr. Price of Lincoln Lane, the accident in question occurred.

On this occasion, the raw turpentine, together with its impurities, was put directly into the still, along with the proper quantity of water, and the boiling rosin at the end of the operation strained from the chips.

The chip cake resulting from a single operation thus conducted, was laid in a heap outside the still house, at three o'clock in the afternoon, and at midnight was observed to be in flames.

In the first mentioned process it is obvious the chips were never exposed to a higher degree of temperature than 212°; but in the latter, especially when it is the object of the manufacturer to make amber rosin, the temperature to which they are exposed is much higher.

The first experiment I made was on the 16th of March. I found the temperature of the boiling rosin, in the still, to be 250° when the turpentine oil and water had been distilled off, the fire just drawn from under the still, and when the liquid rosin was in the act of being strained from the chips which were introduced into the still with the turpentine.

I had the whole of the chip cake resulting from this distillation carried into my own yard, upon a wire screen, and left in the open air, with a view of watching its progress.

The temperature increased gradually in the centre of the heap, although externally it became quite cold and brittle. In four hours, in fact, a thermometer thrust into the centre of the *porous*

mass indicated a temperature of 400°; a good deal of vapour was now given off, and the adhering rosin in the heated parts began to acquire a high colour: the smell could be perceived at a considerable distance from my premises; it was a mixed smell of pitch and rosin.

The chip cake, in this experiment, was first exposed to the air at one o'clock in the afternoon, and, though it rained during the night, at half-past seven the following morning it burst into a flame.

In a second experiment, I placed the chip cake in an open tar barrel, having three holes bored in its bottom, about two inches diameter each, and it did not take fire till the expiration of thirty-six hours; but the temperature of the mass was lowered by removal from the wire strainer to the barrel, and besides, I am of opinion the limited access of air retarded the combustion.

In a third trial which I made, combustion took place in five hours: but in this experiment the temperature of the boiling rosin drawn from the still was 260°, and the chip cake was laid, as in the first experiment, on the wire screen; the wind, too, was very high. The screen, in this case, was raised a few inches from the ground, in order to let the rosin, as it melted, drip away, which it did in abundance.

It appeared to me as if the porous mass became slowly red hot, in the centre, like a pyrophorus, and as if the vapour and gaseous matter arising from the decomposed rosin which lay immediately beneath, were inflamed on coming in contact with it. I was standing by when it suddenly burst into flame, and I thought, at the time, had the melted rosin been permitted to drop into water, or had it fallen to such a distance as not to be kept liquid by the radiant heat from the red hot mass above, that there would have been no flame, but silent combustion.

I have since learned from Mr. Price, in whose distillery it has always been the practice to put the unstrained turpentine into the still, that he was well aware of the fact which it is the object of this paper to record, from a fire having occurred several years ago on his premises, when in the possession of his predecessor, Mr. James Price, and that, ever since, they cool down the chip cake, immediately on removal from the still, with water, and afterwards use it as fuel under the still.

An instance of spontaneous combustion occurred with my friend Mr. Philip Coffey, of the Dock Distillery, which is worth relating while on this subject.

He had made a quantity of the mixture used in theatres for producing red light, a powder consisting of nitrate of strontian, sulphur, chlorate of potash, and sulphuret of antimony, with a little lamp-black. A paper parcel of this "red fire," of about a pound or two by weight, was left by him on a shelf in a store-room where there was no fire nor candle light; the following day, while reading in an adjoining room, he perceived a smell as

if some of this powder were burning, and, on examination, he found it had ignited spontaneously on the shelf and was actually consumed.*

ANALYSIS OF THE ZEM-ZEM WATER.

At the Royal Society, on May 14, a paper was read, entitled, "An Account of the Water of the Well *Zem-zem*, with a qualitative analysis of the same by Professor Faraday;" in a letter from John Davidson, Esq.

The author having, during his stay at Jedda, the port of Mecca, succeeded in procuring about three quarts of the water from the well of *Zem-zem*, to which the Mahomedans ascribe a sacred character and extraordinary virtues; and wishing to preserve this water for the purposes of analysis, had the can in which it was contained carefully sealed; but, unfortunately, on its arrival in the London Docks, the can, notwithstanding the directions written on it, was opened, and the gas with which it was highly charged, and by which it held in solution a very large quantity of iron and other matters, was allowed to escape. The precipitate thrown down, in consequence of the loss of this gas, was found, by Professor Faraday, to consist of carbonate of protoxide of iron in the enormous proportion of 106·8 grains to the imperial pint of water. The clear fluid was neutral, and contained much muriate, and a little sulphate, but no carbonate; together with a little lime, potash, and soda. There was also found an alkaline nitrate in considerable quantity; this Mr. Faraday conjectures to have been saltpetre, which had been added to the water by the priests.†

THEORY OF RESPIRATION.

At the Royal Society, on May 14 and 21, a paper was read entitled, "Observations on the Theory of Respiration." By William Stevens, M.D., D.C.L. Communicated by W. T. Brande, Esq., V.P.R.S.

From the fact that no carbonic acid gas is given out by venous blood when that fluid is subjected to the action of the air-pump, former experimentalists had inferred that this blood contains no carbonic acid. The author of the present paper contends that this is an erroneous inference; first, by showing that serum, which had been made to absorb a considerable quantity of this gas, does not yield it upon the removal of the atmospheric pressure; and next, by adducing several experiments in proof of the strong attraction exerted on carbonic acid, both by hydrogen and by oxygen gases, which were found to absorb it readily through the medium of moistened membrane. By means of a

* Thomson's Records, No. 8.
† Philosophical Magazine, No. 38.

peculiar apparatus, consisting of a double necked bottle, to which a set of bent tubes were adapted, he ascertained that venous blood, agitated with pure hydrogen gas, and allowed to remain for an hour in contact with it, imparts to that gas a considerable quantity of carbonic acid. The same result had, indeed, been obtained, in a former experiment, by the simple application of heat to venous blood confined under hydrogen gas; but on account of the possible chemical agency of heat, the inference drawn from that experiment is less conclusive than from experiments in which the air-pump alone is employed. The author found that, in like manner, atmospheric air, by remaining, for a sufficient time, in contact with venous blood, on the application of the air-pump, acquires carbonic acid. The hypothesis that the carbon of the blood attracts the oxygen of the air into the fluid, and there combines with it, and that the carbonic acid thus formed is afterwards exhaled, appears to be inconsistent with the fact that all acids, and carbonic acid more especially, impart to the blood a black colour; whereas the immediate effect of exposing venous blood to atmospheric air, or to oxygen gas, is a change of colour from a dark to a bright scarlet, implying its conversion from the venous to the arterial character: hence the author infers that the acid is not formed during the experiment in question, but already exists in the venous blood, and is extracted from it by the atmospheric air. Similar experiments made with oxygen gas, in place of atmospheric air, were attended with the like results, but in a more striking degree: and tend therefore to corroborate the views entertained by the author of the theory of respiration. According to these views, it is neither in the lungs, nor generally in the course of the circulation, but only during its passage through the capillary system of vessels, that the blood undergoes the change from arterial to venous; a change consisting in the formation of carbonic acid, by the addition of particles of carbon derived from the solid textures of the body, and which had combined with the oxygen supplied by the arterial blood: and it is by this combination that heat is evolved, as well as a dark colour imparted to the blood.

The author ascribes, however, the bright red colour of arterial blood, not to the action of oxygen, which is of itself completely inert as a colouring agent, but to that of the saline ingredients naturally contained in healthy blood. On arriving at the lungs, the first change induced on the blood is effected by the oxygen of the atmospheric air, and consists in the removal of the carbonic acid, which had been the source of the dark colour of the venous blood: and the second consists in the attraction by the blood of a portion of oxygen, which it absorbs from the air, and which takes the place of the carbonic acid. The peculiar texture of the lungs, and the elevation of temperature in warm-blooded animals, concur in promoting the rapid production of these changes.*

* Philosophical Magazine, No. 38.

MANUFACTURE OF SALT.

At the Royal Institution, on March 21, Mr. Cartmael gave an account of some modern improvements in the manufacture of salt.

The manufacture of salt consists in evaporating the natural brine, or artificial brine formed from rock-salt, till the salt crystallizes; and the higher the temperature at which this is carried on, the finer is the salt. In the old process, rectangular flat iron pans, of a moderate size, were used as boilers; but of late very large pans have been introduced; and there is at present a salt manufactory, in which the extent of pannage is three miles long by eight feet wide.

The chief improvements in the manufacture of salt consist in avoiding the evil effects of the "pan-scratch"—a technical term given to the earthy matter which used to incrust the bottom of the flat boilers, and cause the rapid destruction of the iron by the fire: also in economizing the heat. To gain these ends the boilers or pans are made very long, and the fire is applied only to a part. Above the part which is over the fire a cover is fixed, which dips a little way into the boiling fluid, so that the steam which is driven off is passed through a pipe at the top of the cover, and employed in warming other pans producing salt of inferior quality.—The bottoms of the boilers exposed to the fire are concave; and the fire being applied only to the middle, the collection of earthy matter on the heated parts of the boiler is avoided.—The hot water formed by the condensation of the steam is applied to warm fresh brine, to be admitted to the pans; and the heat of the flues from the fire is employed in a "stoving-house" to dry the manufactured salt.*

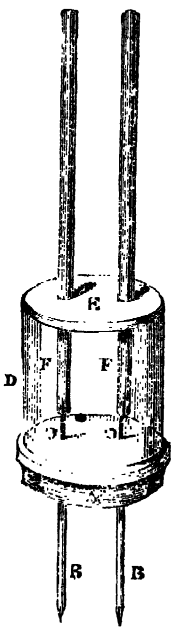
OPTICAL EFFECTS OF THE MAGNETIC-ELECTRICAL MACHINE, AND ON AN APPARATUS FOR DECOMPOSING WATER BY ITS MEANS.

By Mr. Edward M. Clarke.

Trying the effect of the magnetic electrical machine on the optic nerves, I observed the following curious phenomenon. On grasping in one hand (which had been previously wetted with vinegar) one of the conductors, insulating the other hand with a glove, and slightly pressing the extremity of the other conductor to the wetted forehead, the mouth was affected with a metallic taste, similar to that produced when silver and zinc are brought into contact with the tongue, but much stronger. On closing my eyes I observed, where the conductor touched the forehead, a luminous disk, the light of which emanated in waves from a bright spot in the centre. The luminous disk was bounded by a strongly marked black circle, outside of which was more light, similar to that of the disk, but of less brilliancy. On com-

* Athenæum, No. 283.

municating this to Dr. Faraday, he kindly suggested the trying the effect of a piece of wetted paper placed between the forehead and the conductor: the result was, the figure was better defined and more vivid. He further recommended the trial of a metallic disk, point, and line, successively, instead of the hollow cylindrical conductor as before; but no apparent change was visible in its effects. The arrangement of the terminating wires of the conductors is the same as already described in my former paper, p. 169. Care must be taken that the wires of the conductors are not removed from the mercury in which they are immersed, otherwise (as I have experienced) a violent *secondary* shock will be felt.



The apparatus heretofore used for the decomposition of water being defective, in so far that the connexions were imperfectly formed, did not thoroughly answer the purpose intended for the magnetic electrical machine. I send you a sketch of one constructed by myself, which answers *fully* the purposes for which it was intended, and has given satisfaction to all who have obtained them from me.

A. A hard wood cup.

B B. Two copper wires, having two platinum wires.

C C. Soldered to their extremities.

D. A piece of glass tube cemented into A.

E. A cork fitting loosely into D.

F F. Two glass tubes closed at one end and fitted tightly into E.

Introduce B B into the connecting holes of the magnetic electrical machine, and move E F F from D; pour dilute sulphuric acid into D, so as to cover C C; fill the tubes F F also, and place them as before.*

TEMPERATURE OF VAPOURS FROM BOILING SOLUTIONS.

Professor Rudberg has ascertained, by a series of careful experiments, that the temperature of the vapour arising from a boiling solution of any salt is independent of the nature and quantity of the salt, and is absolutely the same as that of the vapour of pure water under the same atmospheric pressure.

This is in direct opposition to the statements of Biot, Gay-Lussac, and Pouillet, who assert that the temperature of the vapour arising from a boiling saline solution is the same as the temperature of the highest stratum of the liquid.

* Philosophical Magazine, No. 36.

The translator of the preceding notice was unable to detect any difference between the temperature of the vapour of water and that of a solution of common salt which boiled at 221° Fahr.*

VESUVIUS.

On March 27, Dr. Daubeny read before the Ashmolean Society of Oxford, a communication on Vesuvius, and the nature, of volcanic agency.

He began by giving a brief account of the great eruption of Vesuvius which occurred in the month of August of last year, and which had been preceded by a series of ejections of stone and scoriæ from the crater, continuing at intervals ever since the year 1831.

These ejections had by degrees occasioned the formation of two conical hillocks within the area of the crater, the most considerable of which, just before the breaking out of the eruption of August, was more than 200 feet in height. Both the above, however, disappeared at an early period in the course of the eruption, having been swallowed up within the mountain during the course of a single night.

The lava which first burst forth took the direction of Portici, but this stream proceeded but a short way down the flanks of the mountain, owing to the breaking out of a more considerable current on the opposite side of the mountain.

This latter took the direction of the township of Ottayano, sweeping away in its course several small villages, and about 180 houses.

The lava when visited by Dr. Daubeny even so late as the end of December, or four months after the time of its emission, still possessed a high temperature, and was exhaling much steam, free muriatic acid, and sal-ammoniac; which latter appears from former observations to be a common product of volcanic action.

It remains to be explained, first, how this and other volatile matter can remain for so long a time pent up within the substance of the heated mass; secondly, how this salt was in the first instance generated in the bowels of the earth.

The first question may perhaps be answered by supposing the body, whilst within the mountain, to have been entangled in the lava, and there to have been confined by the enormous pressure of the superincumbent mass; so that when the eruption took place, the volatile matter did not at once find the means of escape, but continued in part locked up within the pores of the viscous mass.

The second question requires for its answer a consideration of the causes of volcanic action in general.

The president brought forward some facts and authorities

* Philosophical Magazine, No. 38.

bearing on the question whether Pompeii was destroyed by the eruption of A. D. 79.

That Herculaneum and Pompeii suffered from an *earthquake* in A. D. 62 or 63, appears from Tacitus Ann. XV. 22, and Seneca Nat. Quæst. VI. l.

Pliny in mentioning the eruption says nothing of these cities. VI. 16, 20.

Tacitus speaks of *some* cities being destroyed during the reign of Titus A. D. 79—81.

Dio Cassius (in A. D. 229) expressly says, that Herculaneum and Pompeii were destroyed by an eruption in the reign of Titus (LXVI. 23.)

From Statius (A. D. 95.) it would seem they were not *wholly* destroyed. Florus (A. D. 116—120) mentions them as still existing.

M. Aurelius, however, mentions them as entirely destroyed before A. D. 161 (IV. 18); as also Tertullian (Apol. 40) in A. D. 200.

Some further discussion took place: and Mr. Twiss mentioned, as a well ascertained fact, that Stromboli is always active when the Sirocco blows, but at no other time.*

MAGNETO ELECTRIC INDUCTION.

By Mr. F. Watkins.

The production of motion by magneto electricity is not new, many philosophers having already suggested and prepared various mechanical contrivances by which a body might be made to move continuously by magneto-electric agency.

Among the contrivances with which I am acquainted, none can vie, either in simplicity or in beauty of design, with that which emanated from the ingenuity of Mr. Saxton. The instrument as originally constructed by him may be daily seen in operation at the Gallery of Practical Science in Adelaide Street.

Having been, as you know, for a long time extensively engaged in the construction of electro-dynamic and magneto-electrical apparatus, on seeing Mr. Saxton's machine, I, with his permission, immediately commenced making one nearly after his fashion, and afterwards conceived that it might be made to show an increased number of phenomena. Following out my ideas experimentally, I obtained distinct revolutions from eight magnetic needles, together with the vibration of a *ninth*. I am not aware that a multiplication of motion to this extent has been achieved before; indeed, by applying a second electro-magnet seventeen bodies might be put in motion at the same time, and by a judicious arrangement even more.

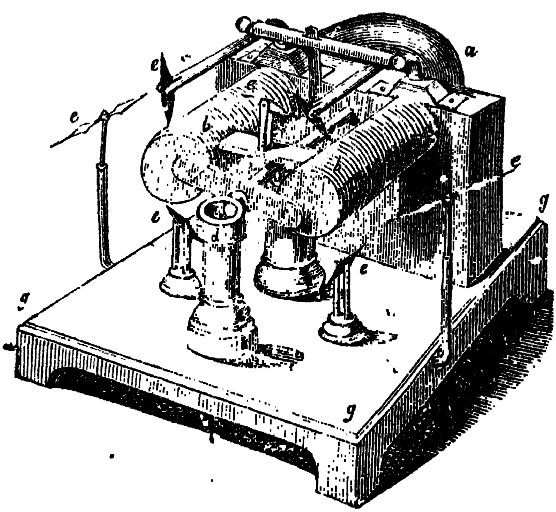
The drawing which accompanies this communication repre-

* Records of General Science, No. 8.

sents my apparatus. In arrangement it varies very little from that of Mr. Saxton's, the difference being merely in this respect, that Mr. Saxton places the *axis* which carries his *main* revolving permanent magnet *outside* of the electro-magnet, while my axis is situated *inside*. The only advantage I obtained is that the apparatus is much more compact. Were this all I have to advance on the subject, I should not trouble you with the present communication; but as I have added seven permanent magnets in different situations, and succeeded in obtaining continued rotatory motion in all, I conceive that I have thus rendered the magnetic toy somewhat more interesting.

The revolving magnets I have had in motion for eleven hours without superintendence, and they were only stopped when my workshop was closed for the day. The chemical action on the copper and zinc elements of the voltaic battery employed to induce polarity in the soft iron by means of the copper wire surrounding it, is produced merely by salt and water (not nearly so strong as sea water); and I have a solution of this kind constantly in use, which has been mixed above a month, and when the metallic elements are now placed in it, the magneto-electric machine in question acts without sensible diminution of force.

The pendulum and suspended magnetic needles of this toy at times exhibit in a modified form a beautiful experiment of M. Plateau recorded in *Correspondence Mathematique et Physique*, par M. Quetelet, tom. vi. p. 70 (1830).



(*a*). A piece of soft iron bent in the form of a horse shoe magnet,

partly surrounded as at *b b* by copper wire covered with silk in the usual manner.

(*c*). A permanent magnetic needle revolving on an axis as represented in the figure, which axis has a contrivance of points dipping successively into a divided cup of mercury, one division of which is in connexion with the copper element of a voltaic circuit, and the other in connexion with the zinc element. The cup for the mercury cannot conveniently be shown in this figure, but it is placed so that the points on the axis, which have the effect of changing the current in the copper wire enveloping each arm or branch of the soft iron, may dip into it successively as the axis rotates.

(*d*). A cup of mercury connected with one end of the copper wire coiled on the arms of the soft iron, while the other end of the wire is immersed in a similar cup situated at the other end of the axis, which it was impossible to show in the figure.

(*e e e e e e*). Traversing magnetic needles; two, *é é*, revolve in a horizontal plane, the five former in a vertical plane.

(*f*). A pendulum, consisting of a magnetic bar suspended by one end, which oscillates as already described.

(*g g g*). A mahogany stand or base for supporting the apparatus.*

PECTIC ACID.

M. Simonin of Nancy has ascertained an improved method of preparing this acid. The pectine and jelly which are formed by the mixture of the juice of gooseberries with that of sour cherries, is to be separated from the liquid part and well washed, to separate the colouring matter. It is then boiled with a small quantity of weak caustic potash. The liquid which contains pectate of potash is then passed through a cloth filter. The pectate is decomposed by agitation with chloride of lime. Decolouration quickly takes place, and white flocks of pectate of lime separate. These are collected on a filter and treated with water acidulated with muriatic acid, which decomposes it and dissolves the lime. The pectic acid is allowed to drop upon a cloth, and is well washed with water in order to take up all the muriate of lime and acid which it retains. In this state pectic acid is almost colourless, in the form of a compact jelly. It combines with the greatest ease with alkalies. A few drops of ammonia liquify it and give it a brown colour. If we wish to prepare pectate of ammonia, a sufficient quantity of this alkali is added to give it the consistence of syrup, which is filtered. It is then dried in porcelain vessels, where it separates into brown glassy plates. It is soluble in water from which alcohol and sugar separate the pectic acid in the form a jelly.

It is necessary in washing the pectic acid to employ water containing neither lime nor calcareous salts, because the pressure of the smallest portion of these substances will occasion the production of pectate of lime, and prevent success. Two hundred

* Abridged from the Philosophical Magazine, No. 38.

pounds weight of red gooseberries afford nearly 8 ounces of pectate of ammonia, giving a gelatinous consistence to 500 times its weight of water.*

PHOSPHATE OF QUININE.

PHOSPHORIC acid bearing a nearer relation to the animal economy than sulphuric acid, Professor Harles proposes to substitute the phosphate for the sulphate of quinine in medicine (*Pharm. Zeit.*) The method which he described for forming it is considered imperfect by *Winkler*, who recommends the following:—He first prepares a muriate of quinine, by decomposing the sulphate with chloride of barium; 1,200 parts of the latter are triturated with 480 parts of crystallized sulphate of quinine. This mixture is then added to 8 parts by weight of distilled water. The liquid is filtered and the residue washed. The liquors are united and diluted with 4 times their weight of distilled water. A solution of phosphate of ammonia is then carefully added. The precipitate should be washed with cold distilled water and dried at a gentle heat; and excess of phosphate of ammonia should be avoided, because it dissolves the phosphate of quinine; 60 parts of muriate of quinine afford 46 of phosphate. It is a fine crystallized powder, very light, white, and very bitter. When a solution of it in boiling water is cooled, it is deposited in silky needles. It is soluble in 489 parts of cold and 140 of boiling water. It consists of quinine 87·03, phosphoric acid 12·97. Winkler has since stated that it may be formed by the mutual action of sulphate of quinine and sulphate of ammonia.†

CASES OF POISONING IN FRANCE.

THE number of cases of poisoning in relation to the poisons employed, are as follows, in the space of 7 years:—

1. Of 273 persons accused of the crime of poisoning, 171 have been acquitted and 102 condemned. Of 94 cases reported in the *Gazette des Tribunaux*, 54 were produced by arsenious acid, 7 verdigris, 5 powder of cantharides, 5 corrosive sublimate, 4 nux vomica, 3 fly powder, consisting of impure pulverized arsenic called also *cobolt*, 2 nitric acid, and single cases by sulphuret of arsenic, emetic, opium, acetate of lead, ceruse, sulphuric acid, sulphate of zinc, mercurial ointment, and 5 by undescribed poisons.

2. The causes which produced the crimes have been interested motives in 28 cases, in 24 lewdness, 15 revenge, 10 jealousy, 6 madness. Of 81 cases the poison was administered, in 34

* Journal de Pharmacie, quoted in Thomson's Records, No. 8.

† Buchner's Repert. and Journ. de Chim. Medic. quoted in Thomson's Records, No. 8.

cases in soup, 8 in milk, 7 in flour, 7 in wine, 8 in bread, 5 in pies, 4 in chocolate, 4 in medicines, 2 immediately by the mouth, 2 in coffee, 1 in cider, 1 in poultry.*

3. Of 94 cases, 60 of the accused persons were males, 34 females.

In order to diminish the number of these cases, or if possible to destroy the practice of poisoning altogether, it has been proposed by M. Brard to colour arsenic with Prussian blue in the proportion of 10 per cent. The propriety of this method is supported by the fact, that by far the majority of cases of poisoning are produced by colourless poisons, arsenic in particular, and several persons have been prevented from suffering death by poison, in consequence of coloured substances having been employed for that purpose.*

NEW YELLOW DYE FOR WOOL.

Gregoire Sella recommends the *Rhus radicans* as an excellent dye. For eight parts of wool take of *Rhus radicans*, previously boiled 8 parts, alum 1 part, cream of tartar 1 sixth part, muriatic acid solution (consisting of muriatic acid 4 parts, pure tin ½ or 1 part.) 1 part. Boil them for ¾ of an hour; a fine yellow colour is produced. If the dried plant is used, a pale yellow or hazel colour is obtained. This colour resists soap and the sun as well as the other yellow colours. It acquires greater stability if allowed to remain 12 hours in the vat.†

NEW FACTS, REPORTED TO THE BRITISH ASSOCIATION

Iron and Sea-Water.—A paper was read by Mr. Davy, upon the subject of the corrosion of iron by sea-water. The observations had particular reference to the injury sustained by the iron of buoys subjected to the influence of sea-water in harbours, as at Kingstown; where it was recently found that the rings, upon which the safety and utility of the buoys mainly depend, rapidly corrode and are destroyed. Mr. Davy turned his attention to the important object of providing a remedy, and preventing the corrosion of the iron; and although his experiments had only recently been commenced, still he considered it proper to bring the few results he had procured before the Section, for the purpose of exciting further inquiry. He found that zinc applied to iron prevented corrosion. Rings of this metal were cast into forelocks for the purpose of experiment, and were found to obviate the waste to which the iron had previously been subject. According to Sir Humphry Davy, the cause of the corrosion of copper and metals in contact with sea-water, is attributable to the access of atmospheric air. He considered that if the air was preserved from coming in contact with the metal, no decomposition would ensue. Mr. Davy accordingly found, that copper exposed to the action of sea-water,

* Thomson's Records, No. 8.
† Bibliotheque Universelle, quoted in Thomson's Records, No. 8.

free from the influence of air, was not liable to corrosion, and that the effect was influenced by the depth of water. Specimens of metals were exhibited, which had been subjected to the influence of salt water free from air, and no corrosion had taken place; other pieces of metal which were in contact with sea-water, subject to the influence of air, were observed to be much injured. Mr. Davy attributed the cause of the phenomenon to an electrical decomposition. He stated further, that he had found zinc to preserve tin-plate, both in fresh and salt water.

Safety-Lamps.—Mr. Ettrick described an improvement which he had made upon Davy's safety-lamp, for the purpose of obviating accidents which are entirely owing to the carelessness of workmen. The Davy lamp, he stated to be perfect in principle. The workmen are in the habit of enlarging the apertures in the wire gauze, and applying their tobacco pipes in order to obtain a light. The modifications recommended at present were, the introduction of very strong glass, to cover the gauze externally. The glass is again guarded by strong ribs of iron, so that the lamp may be exposed to considerable shocks without danger of injury. A contrivance was also described by which the air was allowed to enter from below, by means of a gauze tube, but so managed that the gauze could not be reached by the workmen. Various improvements upon the Davy lamp were noticed by different members. Mr. Graham stated, that he had found that when the gauze was steeped in an alkaline solution, the flame was prevented from passing so readily, and corrosion was obviated. He considered the only adequate provision against accident to be the employment of a double gauze cover.

Symbols.—A letter was read from Dr. Turner, reporting the opinion of the committee appointed at last meeting to take into consideration the adoption of a uniform set of chemical symbols for this country. The opinion of the majority was, that those used on the Continent should be had recourse to. It was strongly recommended that the abbreviations should not be carried further than the dots for oxygen; indeed, it was suggested by some that these should be rejected, as they merely express theory, and, consequently, vary according to the view that is taken of the composition in this country and on the Continent; but it is obvious, that if brevity is not carried any further than this, no bad consequences can follow from a system of notation. Dr. Thomas Thomson strongly recommended that the centigrade thermometer should be adopted in this country for scientific purposes, as being infinitely better adapted for such purposes than that of Fahrenheit. His suggestion appeared to coincide exactly with the opinion of the Committee.

Dr. Dalton subsequently introduced the subject of a system of chemical-symbols, by explaining his ideas respecting the composition of the simple compounds, and exhibited the expressions which he proposed many years ago, to give a pictorial view of the mode in which the atoms are collocated. He considers the composition of nitrous oxide to be two atoms azote, adopted by Berzelius, who has not stated from whom he obtained it. Olefiant gas, he considers, is composed of single atoms of carbon and hydrogen, while the gas which exists in coal, though commonly termed olefiant gas, is, in reality, double olefiant gas, and is termed by Dr. Dalton bin-olefiant gas. This is proved by its affording twice the quantity of carbonic acid, and requiring twice the quantity of oxygen to burn it which olefiant gas requires. Mr. Whewell observed, that the atoms might as well be supposed to be arranged in lines, as in

the mode represented by Dalton, which was objected to by the latter, as being a tottering equilibrium.

Tin-plate.—Mr. Davy detailed some experiments which he had made upon the preservation of tin-plate by the agency of zinc. When exposed for some days to the action of water, the plate by itself soon becomes slightly corroded, but is completely preserved by the zinc, the latter at the same time oxidizing. Hence, the plate might be employed in place of copper for many purposes, where salt water comes in contact with vessels. Several metals, he had ascertained, are not protected.

Volatilization of Magnesia.—Dr. Daubeny stated that, according to the opinion of Von Buch, carbonate of magnesia must have been sublimed in many instances by volcanic action, although, as far as Dr. Daubeny was aware, it was not agreeable to the results of chemists. A curious fact illustrative of the truth of Von Buch's opinion occurred to Dr. Daubeny in Italy. He visited a locality where there was an upper stratum of lava, containing cavities. In one of these Colonel Robinson discovered a large quantity of carbonate of magnesia. Dr. Daubeny found a quantity coating the upper surface of the lava. Dr. Dalton observed, that there could be no doubt as to the sublimation of carbonate of magnesia, as Dr. Henry had informed him that a quantity of this salt was always driven off at a heat beyond a certain height.

Caoutchouc.—Dr. Dalton stated the results of his examination of the spirit distilled from caoutchouc. He found it to depress the barometer like sulphuric ether. It passes through water without diminishing its volume, thus differing from ether. It is absorbed by water like olefiant gas. It consists of 2 olefiant gas Ten volumes when burned give 40 carbonic acid, and require 60 of oxygen. It appears to be the same as a substance described by Faraday. It differs from coal-gas in this, that the latter consists of double olefiant gas.

Gas-lighting.—Mr. Mallet described the phenomena presented in lamps, when the holes for the passage of the gas are made as small as possible, and also the appearance observed when the direction of the tube is inclined in different ways, two currents being formed when the tube is inclined, and the surface of the flame presenting spiral lines, and considerable retraction of the flame taking place, none, however, occurring when the tube is not fully inserted. The apertures in the lamp were less than the 1·100 of an inch in diameter. In the discussion which arose from this communication, Dr. Dalton observed, that twelve small holes in a lamp consumed less gas and gave more heat, than when the holes were larger but fewer in number. But the great object in procuring a proper quantity of heat depends upon the atmospheric air being neither too great nor too small in quantity. He stated, that if we take a cubic inch of pure gas, and another diluted with half its volume of air, each gives out the same quantity of heat, but the latter scarcely yields any light. This is an important fact, and deserves to be known.

Fossil Scales.—Mr. Connell read a paper, in which it was his object to point out some chemical facts, by which we may be enabled to detect whether a fossil scale be that of a fish or sauroid animal, and illustrated his position by some analyses which he had made on recent crocodile and fish scales, and upon the scales found at Burdiehouse. His inference was, that chemical analysis completely proved that the scales found at Burdiehouse were those of fish, as had been already shown to be the

case, but on other grounds, by Professor Jameson. He considers the animal matter to be replaced by a little carbonate of lime and silica.

Electrometer.—Mr. Snow Harris exhibited an apparatus, or modified electrometer, for performing the experiments of Pouillet, by which the insulation of the gold leaves is rendered independent of the glass, by means of two rods, terminating in gilded balls. To determine whether electricity is developed during the evaporation of water or any liquid, a platinum crucible, containing the substance to be examined, is placed upon the cap of the electrometer, having one of Deluc's small piles communicating with the rods. His results were contrary to those of Pouillet.

Air-blasting Iron.—Mr. Hartop made a communication on the use of the air-blast in the manufacture of pig-iron, in which he showed that the saving said to be effected by the use of hot air had been overrated, as a considerable portion of the alleged saving had been previously effected by other improved processes. The general saving on the average, he stated to be no more than 10*s.* per ton, and observed that the price of *such* iron in the market had actually fallen from 15*s.* to 20*s.* per ton, while that from cold air at the same time rose 5*s.* per ton in Yorkshire. This statement gave rise to observations on the part of several gentlemen who differed from Mr. Hartop, as the reduction in the price of iron from hot air had not occurred in other parts of the country, and that, as prepared in Glasgow, and many other places, it had not been so deteriorated. It has, in consequence, been adopted in every smelting-house in Scotland, and the annual produce of the works in that country during the last ten years has been nearly doubled. Reference was also made to processes adopted in the Russian smelting-works, which showed that, by a judicious adjustment of the quantity of cold air introduced by the blast, a saving could be effected approaching even to that obtained by the use of hot air.

Specific Heats of the Gases.—A paper was then read by Dr. Apjohn on a new method of determining the specific heats of the gases. Having arrived at an accurate formula representing the relation between the temperature of the wet-bulb thermometer and dew-point, including the specific heat of air as a coefficient, he was enabled, by observations of the drepression in perfectly dry air, and the application of the formula in question, to determine the specific heat, not only of air, but of a variety of other elastic fluids. His results are, that all gases but hydrogen have, under equal volumes, specific heats proportional to their specific gravities; so that, with the exception just mentioned, all have, under equal weights, the same capacity for caloric.

Nicotine.—Mr. Davy described some experiments which he had made in reference to the relative values of Virginian and Irish tobacco. He procured nicotine by simply digesting the leaves in potash, and then distilling. A liquid possessing uniform qualities passed over. The liquid is acted on by acids, affording salts possessing a sharp biting taste. The effect of the liquid was tried upon different animals, and found to be highly narcotic. He found that 1 pound of Virginian tobacco was equivalent to 2¼ of Irish tobacco; the root containing 4 or 5 per cent. of nicotine. The usual estimate of the relative values, is as 1 to 2.

Lead Pipes.—Mr. Moor mentioned a curious circumstance in reference to the corrosion of lead pipes. The worm of a still used for preparing medicated waters, was exhibited, which was corroded completely

through its substance, at those points where it had been supported with wood and tied with twine. At these points a black substance was formed, consisting of oxide and chloride of lead. It was obvious that the effect was to be attributed to galvanic action.

Peroxide of Iron.—Dr. Barker described a new mode of separating the per-oxide of iron by means of acetate of potash. The latter salt, when added to a solution of per-salt of iron, precipitates the peroxide when the liquid is boiled. This would appear to afford an elegant method of separating iron from manganese. He made an observation relative to the precipitation of magnesia by phosphate and carbonate of ammonia; viz. that the same precipitation takes place with bi-carbonate of potash, and other salts.

Prussic Acid.—Dr. Geoghehan suggested the advantage of employing the double salt of iodide of potassium and bicyanide of mercury, for the purpose of detecting muriatic acid in prussic acid. Sulphuric acid is frequently met with in prussic acid, but the distinction between these two acids is readily made, by means of nitrate of barytes. The peroxide of mercury, usually employed for testing the purity of prussic acid, is ambiguous in its action, as it is usually impure. The use of this salt is not applicable to the alcoholic prussic acid.*

VELOCITY OF ELECTRICITY.

The following notice of Professor Wheatstone's very interesting experiments on *the velocity of Electricity*, will enable the reader to form a general conception of them. Two very great difficulties present themselves in this inquiry, the one arising from the circumstance that the sensation of light on the retina continues longer than the impression which produces it, as is illustrated by the well known experiment of a luminous circle being produced by a point of light in rapid rotation; this prolongation, very manifestly, is a great obstacle to the exact measurement of the duration of the impression: the second difficulty is the prodigious extent of any conductor that could be used for the purpose of exhibiting any appreciable difference in the transit of a spark from one point to another. The immense velocity of electricity makes it impossible to calculate it by direct observation; it would require to be many thousands of leagues long, before the result could be expressed in the fractions of a second. It being thus impossible to arrive at any result by direct experiment, the Professor had to task his ingenuity that he might attain his object in some other way. After many fruitless attempts, he availed himself of the following expedient, which has already yielded many interesting results, and which he hopes still farther to improve, and render practically useful. He placed a double metallic mirror at the extremity of an axis of rotation, to which, by means of a large spinning-wheel, he could give an exceedingly rapid motion. The musical tone produced

* Jameson's Journal, No. 38.

by the vibration of a card attached to the axis, supplied the number of revolutions. A luminous point, seen by the reflection of the two faces of the moving mirror, produced, in every semirevolution, two luminous circles, proceeding in the opposite direction to the mirror. All inequalities of the flame were made manifest by the circles appearing more or less distinct. By means of this arrangement, he discovered a series of luminous condensations and dilatations in the flame of hydrogen, when it produced sound in passing through a glass tube. He also observed that the electrical aura, as manifested in erecting feathers, down, &c., was not a continuous stream, but a rapid succession of very minute sparks. He then took a wire half a mile long, which he cut in the middle, and arranged each half in such a way, that both extremities and the central ends were in a line parallel to the mirror, so that the three sparks appeared on one straight line. As this sensation on the retina continued longer than the impression, instead of seeing points, which the three sparks should have produced, he observed three arcs of a circle, the origins of which should commence on the same right line, if the transit at the three sections were instantaneous. He imparted a velocity of 800 revolutions in a second to the mirror. Even at this degree of velocity, the origin of the first and third arcs continued on the same right line, but the middle one was somewhat in advance or behind the other two, according to the direction which was given to the rotation. Here the Professor remarks, that this experiment does not agree with the view that electricity is a single fluid, entering at the one end and issuing at the other, as Franklin's theory requires. As the sparks at the two extremities are always consentaneous, whilst that in the middle appears somewhat later, they indicate a double electrical cause, it may be that of two fluids, or a difference in the equilibrium manifesting itself on both sides at one time. He calculated the rapidity and the duration of the spark by its passage across half a degree of a circle of ten feet radius. The following are the conclusions which he draws: 1st, That the velocity of electricity through a copper wire one-fifteenth of an inch thick, exceeds the velocity of light across the planetary spaces; that it was at least 288,000 miles per second. 2nd, That in breaking the electrical equilibrium in a wire communicating with a Leyden bottle at two surfaces, the electricity appears at the two extremities of the wire at the same moment, and somewhat later at the middle of the circuit. 3rd, That the light of electricity, in a state of great intensity, does not last the millioneth part of a second. 4th, That the eye is capable of distinctly perceiving objects which present themselves for this short space of time.—This experiment is most deeply interesting for science; but it requires to be followed up and varied before comparative and positive results can be drawn. The author has pledged himself to do this, and his additional communications will be expected

with much anxiety. We shall only remark, that many questions will demand a separate investigation. For example:—Does the velocity vary with the intensity? Does it vary with the conductors? Is it the same at all times in the same conductor? If electricity is propagated in the planetary spaces, is its velocity the same as along material conductors?—It can scarcely be doubted that, in electricity of feeble intensity, great differences are observed betwixt the velocity of propagation in the first and the following experiments. If we take a battery which has been for a considerable time in a state of repose, the electricity of feeble intensity will with difficulty, and only after a time, overcome the first inertia; but once overcome, quantities still more feeble will easily pass, either in the same or in an opposite direction. It is in electricity produced by heat that this inequality is most sensible. A similar effect takes place in the electricity produced by gold leaf. It is not after repose that there is the greatest sensibility, but when their primary inertia has been overcome. This circumstance should not be overlooked, either in experiments, or in theoretical conclusions respecting the condition of atoms.*

MR. KYAN'S PATENT PROCESS FOR PREVENTING DRY ROT.†

The most important application of Mr. Kyan's process is to the preparation of timber for ship-building; and with such view, the process has been recommended to the attention of his Majesty's Government, who have caused the merits of the recommendation to be investigated with considerable care. For this purpose, the Lords Commissioners of the Admiralty appointed as Commissioners of Inquiry, Captain John Hayes, Chairman; B. Rotch, Esq.; Professor Daniell; Dr. Birkbeck; and Alexander Copland Hutchenson, Esq. These gentlemen commenced their investigations by experiments and evidence on the 15th of April last, and made their report to the Admiralty on the 9th of June. The evidence was taken at the Admiralty, Whitehall, and Somerset House; and the experiments were made in a tank about 17 feet long, 6 feet wide, and 4 feet 6 inches deep, constructed in the basement of the river front of Somerset House. In this tank was put a solution of 224 pounds of corrosive sublimate, and 1,062 gallons of water, in which were immersed six pieces of timber for experiment, viz. Dantzic fir, Canada red pine, Riga fir, English oak without sap, English oak with sap, and English elm.

We gather from the report, that the result of the comparative experiments, as far as they go, which have been brought under the notice of the Commissioners inclines them to believe, that

* L'Institute, quoted in Jameson's Journal, No. 37.

† See Arcana of Science and Art, 1835, p. 144.

external protection is afforded by Mr. Kyan's process, and that it, therefore, would be found sufficient for canvass and cordage, and for wood under certain circumstances; but it cannot be denied, that the extent of the general efficacy of the process, as regards large timber, must depend upon the fact of penetration or non-penetration, or of some external influence proceeding from the exterior, of which no evidence has been offered to the Commissioners. The experiments made by the Commissioners at Somerset House, indicate a definable penetration of the mercury to a very limited extent; but the Commissioners are not agreed as to whether this fact disproves the possibility of any interior effect of any kind, being produced upon large timber by the process.

"All the persons examined, who have used the prepared wood, are of opinion, that the process renders the ordinary length of time for seasoning timber unnecessary. Sir Robert Smirke, however, thinks that while timber of large scantling may be used the sooner for it, still it would not supersede the usual length of time for seasoning wood for joiners' work."

"As to the strength of the solution, with a view to the expense, there has been great inconsistency in the statements made to the Commissioners. The solution for the experiment at Somerset House, consisted of 224 pounds of corrosive sublimate to 1,062 gallons of water, being rather more than 1 pound of corrosive sublimate to 5 gallons of water, (the proportion last named by Mr. Kyan,) the price of the corrosive sublimate at the time of this experiment being 3*s*. 7*d*. per pound. It was stated by Mr. Kyan that the solution loses none of its strength, and becomes in no way altered by the immersion of the timber; and the greater part of the solution in the tank, at the time of the Commissioners' visit to Mr. Kyan's premises, was stated to have been in the use some years.

"Two bottles of the solution used for the experiment at Somerset House were sent to Professor Faraday, one having been filled before the immersion of the timber, and the other afterwards; and he has stated that they contain the same proportions of corrosive sublimate in solution."

"On the point of expense, it may be proper to observe that the additional cost of building the Samuel Enderbey, a ship of 420 tons, entirely of the prepared timber, was 240*l*.; and it appears that the Board of Admiralty have agreed to pay at the rate of 15*s*. a load extra for such as may be used in the construction of the Linnet."

As to the salubrity of the process, the evidence proves it to have produced no ill effect upon the health of the workmen, who have used the prepared timber for shipbuilding or other purposes. It, however, appears that great caution is requisite in preparing the solution, and in the use of the process.

With regard to its effects on the health of a ship's crew, the

Commissioners observe that the Samuel Enderbey, which was completely built with prepared timber last year, sailed last October for the South Seas; and in three accounts received from apprentices on board her, (none others have come to hand,) one of which was dated lat. 3° S., long. 24° 30′ W., the crew were mentioned as being all well. Another ship, the John Palmer, was extensively repaired in the autumn of 1833 with new timbers and new topsides from the light-water mark; the interior was also new from the lower deck upwards; and the whole of the timber used for these works, as also the plank for the men's fitted sleeping berths, were prepared on Mr. Kyan's plan. Two accounts received from the master since she sailed, one dated on the Line, and the other from the Straits of Timor, state that the crew were all well.

The Commissioners consider it desirable to avoid any risk, by placing provisions in direct contact with the prepared wood; and they suggest that ropes and sails, being much handled by seamen, the raw material of them when prepared, should be washed, prior to being well manufactured.

As to the alleged increased purity of bilge water in ships built of the prepared timber, some that was pumped out of the Samuel Enderbey last autumn, was "perfectly sweet."*

RHODIZITE, A NEW MINERAL.

M. Guston Rose has discovered a new mineral, to which he has given the name of *Rhodizite*, among the tourmalines of the Berlin Museum. There is a good deal of analogy between it and the boracite; it has the same form, hardness, and colour, and the phenomena accompanying its fusion before the blowpipe, with borax, salt of phosphorus, flour spar and silicate of soda; it also acts in the same manner on boracic acid, and dissolves with difficulty in muriatic acid. Its peculiar characters are as follow: it colours at first the flame of the blowpipe green, then green and red, and at last entirely red; when put on burning coals its edges are rounded; it becomes white and then opake, and is covered with excrescences as when it is heated with the blowpipe; fused with a small quantity of soda it forms a white enamel; and when the quantity of soda is considerable it produces a transparent glass, which does not crystallize on cooling; lastly, when it is dissolved in muriatic acid, and ammonia and oxalic acid are added to it, a great quantity of precipitate is formed. It is found in granite; and it adheres so strongly to the red tourmaline, that when separated it has impressions of it.†

* Abridged from the Report, in the Mirror, No. 744.

† Journal de Chimie Médicale, quoted in the Philosophical Magazine, No. 41.

ANALYSIS OF OPIUM.

COUERBE gives the following method for analyzing this complicated substance, as proposed by Gregory:—

The opium is first taken up by cold water, and then concentrated, chloride of calcium is added to the solution, in the proportion of 2 ounces to the pound of opium. It is then boiled and allowed to crystallize. When the whole has become solid, the crystals are submitted to pressure. The crystals contain *Codeine* and *Morphine* united to muriatic acid.

The liquid portion which possesses a very black colour, with the consistence of syrup, contains, *Bimeconate* of *lime,* pure *Morphine, Narceine, Thebaine, Meconine,* pure *Narcotine.* In order to separate these substances, the liquid is brought to the consistence of molasses, and in order to free it from an immense quantity of a peculiar black substance, which is improperly termed fat, it is diluted with water acidulated with muriatic acid. The addition of the acid causes this matter to swim on the surface; it is then skimmed off; it contains much ulmine. Ammonia is next poured into the purified liquid, by which means, *Morphine* and *Thebaine* are precipitated. This deposit is dried, pulverized and treated with boiling ether. The *Thebaine* though little soluble in this liquid, dissolves. The ethereal solution is distilled when the *Thebaine* remains behind in the form of small, reddish crystals. These are purified by dissolving them in alcohol, and by animal charcoal; lastly, in order to have it perfectly pure, it should be dissolved in ether and evaporated spontaneously.

The ammoniacal liquid is concentrated to the consistence of liquid honey, and agitated strongly with ether. This liquid dissolves the *Meconine.* By distilling the ether this substance remains; it is purified by solution in water and charcoal, and when the aqueous solution is evaporated, white crystals of long prismatic needles make their appearance.

When we wish to obtain the other substances, all these processes are not necessary, it is sufficient after having precipitated the infusion of opium by muriate of lime, to concentrate the liquid and treat it directly with ether. By this means, rather more *meconine* is obtained. When the ether has ceased to act, the black liquid thus taken up is decanted and exposed in a cool place where it assumes a crystalline form; it is then expressed and treated with boiling alcohol. The product dissolved in this case is *Narceine.* But it is proper to state, that as this substance is not soluble in ether, and as the black substances which accompany it are soluble in alcohol, there are some difficulties accompanying the process for obtaining it; it is always procured pure by employing boiling water. No notice is here taken of *meconic acid,* which combines with the lime, and forms *bimeconate of lime,* because Robiquet has sufficiently explained the method of obtaining it.

With regard to the double muriate of *morphine* and *codeine*, it is dissolved several times in boiling water, passing it through charcoal in order to decolourize it, or decomposing it by ammonia, which precipitates almost all the *morphine*, and leaves in the solution the *codeine*, with a little morphine combined with the muriatic acid, constituting the salt of Gregory. The morphine is purified by the usual means.

The solution of the triple salt is evaporated until it appears about to crystallize: then caustic potash is added in excess, which precipitates the codeine and retains the morphine in solution; the solution is then heated slightly, and allowed to stand for a day. The codeine, which at first appeared as an oil, crystallizes. It may be purified by solution in ether or alcohol. The former is preferable; because, if it contains morphine, this will be a direct method of separating it. From 40 lbs. of opium Couerbe obtained by this process:—

1	oz.	of meconine
1½	,,	codeine
⅔	,,	narceine
1	,,	thebaine
50	,,	morphine

He did not extract *narcotine*, which exists in the refuse of opium and is well known. These substances present the following appearances when agitated with sulphuric acid containing a little nitric acid. *Morphine* gives a brownish colour. *Codeine*, a green colour. *Thebaine* a yellow rose-colour. *Narcotine*, a blood-red colour. *Meconine*, a turmeric yellow, then a red colour. *Narceine*, a chocolate colour.

Thebaine crystallizes from an ethereal solution, in flat rhomboidal prisms, with a fine lustre, and white colour. It is strongly alkaline.

When exposed to the temperature of 266° it fuses, and becomes solid at 230°. Narcotine fuses at 338°, and solidifies at 266°. Codeine fuses at 302, and meconine at 194°.

The strong acids convert thebaine into resin, when diluted form crystallizable salts. The following results were obtained by Couerbe:—

	Carbon.	Oxygen.	Hydrogen.	Azote.
Narceine	56·818	31·900	6·626	4·656
Thebaine	71·976	15·279	6·460	6·385
Codeine	72·816	14·775	7·148	5·231

The *paramorphine* of Pelletier was obtained by Thiboumery by treating the infusion of opium with slacked lime. He obtained by this means a clear liquid, and a precipitate containing much lime, which was treated with alcohol, and the solution gave, instead of morphine, this new substance, which appears the same as the *thebaine* of Couerbe.

The proportion of *morphine* in opium, Couerbe states may be determined in the course of two hours, by boiling the infusion of opium with an excess of lime, and passing the solution through

a filter. If an acid be added, taking care not to add it in excess, the morphine precipitates.*

PAPER-MAKING, FROM BOG-PEAT.

On the Manufacture of White, or Bleached Pulp, for the purpose of making Paper from certain varieties of Peat or Pulp.

At the last Meeting of the British Association, Mr. Mallet enumerated the following experiments to obtain a cheap and yet good substitute for hemp-rags, for affording a pulp fit for paper-making, which has long been a desideratum with the manufacturer. Many attempts have been made to procure one, but the difficulties of finding one such as would suit the required conditions, and the duty and cost of hemp-rags, have induced adulteration to a vast extent in the paper-manufacture. Much of the letter-paper now in use owes its apparent thickness and stiff, close texture, to an intimate admixture of the pulp or vegetable fibres with a cream of plaster of Paris or whiting. Brown paper is adulterated with ground clay, and, for similar purposes, curriers' shavings, chopped wool and hair, cotton-flyings, thistle-down, and other similar materials, have been occasionally tried: but from none of them has good paper ever been made; and amongst the many experiments that have been attempted with them, being the only one that has been brought into successful use, is that of the manufacture of paper from straw, which answers tolerably for some purposes, though not for writing on, and is now made in some few places very extensively.

Under these circumstances, it appeared probable that nature might afford some vegetable fibres, of a texture sufficiently fine for making paper, and which had never undergone any manufacturing process; and on looking around, the *confervæ* of fresh-waters, and also certain varieties of turfs or peats, suggested themselves. The former was soon found too fragile, and its structure unfit to resist the action of the bleaching re-agents.

It is generally known that a peat-bog, and especially those of Ireland, consists of various strata, varying in density and other properties in proportion to their depth. The top surface of the bog is usually covered with living plants, chiefly mosses, heaths, and certain aquatic or paludose plants; immediately beneath this lies a stratum varying from only two or three inches to four or five feet, according to the state of drainage of the bog, of a spongy, reddish-brown, fibrous substance, consisting of the remains of vegetables, similar usually to those living on its surface, in the first stage of decomposition.

The chemical state of this stratum is nearly that of some of the papyri found in moist places in Herculaneum; that is to say, having long been exposed to the action of water, at nearly a mean temperature, the vegetable juices have nearly all been

* Annales de Chimie, quoted in Thomson's Records, No. 11.

converted into ulmin-geine, or impure extractive matter, and the fibres remain nearly untouched, together, probably, with some of the essential oils of the original plants. It therefore seemed that, if these fibres, which were apparently sufficiently fine for the purpose, could be separated from their colouring matters, the object would be nearly, if not entirely attained; to this, therefore, attention was directed, and was attended with success. It is unnecessary here to enter into any detail of experiments, or into any elaborate disquisition as to the principles concerned, in making a white pulp from this material, either as regards the manufacturer or the pure chemist; presuming these to be already understood, the process may be briefly stated as follows:—

The proper description of turf being selected, is soaked in cold water until all its parts are softened, and, to a certain extent, disintegrated; it is then bruised in a suitable engine, in cold water, which is continually agitated and renewed, so that all pulverulent matter, (or new dust while the turf is dry,) may be washed off. The so far cleansed fibres are then partially dried by strong pressure, in hair bags, under the hydraulic press, or by other suitable means, and then by suitable sieves and winnowing; all roots, sticks, or other gross matter incapable of being bleached, are removed. The fine, uniform, brown fibres, or rather minute stems, leaves, &c. &c. are then placed in proper vats, and digested in the cold; that is, at ordinary temperatures, with a very dilute solution of caustic, potass, or soda; preferring that made from what is called in commerce, "black potash."

After some time, nearly the whole of the geine and other extractive matter is removed, in combination with the alkali. The fibres are again pressed dry, or nearly so, from the digesting liquor, and are now found to be of a dark fawn colour, in place of their former deep red brown. They are next transferred into an exceedingly dilute sulphuric acid, containing not more than fifty grains of acid of commerce, to the quart of water. They remain in this at the common temperature for some time, generally about four hours, but varying with the kind of turf; this separates the iron and earthy matters from the fibre, and carries off the adhering portions of potass and of ammonia, if any exist in the turf, which is occasionally the case. The fibres are now washed with pure cold water, until they cease to give any acid re-action, and are finally pressed nearly dry, and immersed in a dilute solution of chloride of lime; in this they remain at common temperature until sufficiently white for the purpose of the paper-maker, and, on being removed, will generally be found fine enough, as to fibre, for immediate manufacture; but, if not, are to be reduced by the ordinary rag-engine, or other suitable machinery.

By this process it is calculated that about eighteen pounds, weight of pure, white, fine pulp may be procured from 100 weight of the raw or the native turf.

Returning now to the solution of the potass, which has carried off the geine, &c., and which is chiefly, in fact, a geinate of potass; it is treated with dilute sulphuric acid, slightly in excess, and filtered through a calico or linen cloth. The potass is taken up by the acid, and the geine and extractive matter precipitate, and are collected on the filter, from which being removed, they are dried by a steam or water-bath, and become a valuable pigment.

Vandyke brown has long been known to painters in both oil and water-colours. This is it, in fact, in its purest form; it is an extremely rich, glowing colour, and valuable for its permanence, as scarcely any agent ordinarily met with is capable of affecting it.

When once perfectly dried, it becomes insolute in water, and, therefore, is not in the least deliquescent, but it is still soluble in alkalies; thus possessing two properties eminently fitting it for the uses of the paper-stainer and scene-painter, &c. &c. It is perfectly miscible with gum, mucilages, and with oils.

The liquid from which this colour or bistre has been separated now contains various sulphates in solution, chiefly of iron, lime, and alumina; but the major part, sulphate of potass, or soda, whichever has been employed; if the former, Glauber's salt may be made from it, and if the latter, alum, as matters of commerce. The quantity of alkali used is small in proportion to the amount of fluid; but if the operations were very extensive, this economical use of them should be attended to.

After the fibre has been some time digested in the solution of chloride of lime, in most cases a resinous-looking matter floats upon the surface of the fluid in very minute quantity. This, when a large quantity is operated on, may, by careful management, be collected, and is found to be a species of artificial camphor, mixed with some gum resin, and probably an essential oil. This substance, or mixture of substances, possesses some singular characters: it would seem probable that the artificial camphor is produced by the action of some fine chlorine upon turpentine, existing in minute quantity in the turf; and it is a curious subject for reflection, that chemistry should thus, as it were, recall into existence and decompose the turpentine existing in, and produced by trees or plants which have for hundreds of years ceased to have life, or to exist as vegetables. As the properties, so far as they have been ascertained, of this singular substance are purely chemical, it is unnecessary here to detail them. It is not to be procured from every specimen of red or surface turf.

Some specimens of turf have been met with, unfit, however, for paper making, from which it would appear to be profitable to manufacture bistre and ammonia, from the very appreciable quantity of the latter they contain.

This fibrous red surface turf, when dry, is extremely tough,

and is proposed being also applied as a substitute for mill-boards, or board-paper, for the use of engineers, &c. It is capable, when dry, of immense compression by the hydraulic press; and as the fibres naturally lie nearly all in one plane, they thus arrange themselves, so as to give great toughness and flexibility to a plate of it when compressed. Accordingly, suitable masses of this turf are placed in a strong cast-iron, or other vessel, and the air exhausted; the vessel is then filled with a mixture of dilute solution of glue and molasses, at a boiling heat, which fills all the pores of the turf. The masses are then removed, while hot, and exposed to powerful pressure in a hot-press, in a similar way to hot-pressing paper, which reduces them to the required thickness, that of the original mass having been previously properly regulated. The plates so formed are found, when cold, to be hard, tough, and flexible, and will answer almost every purpose of mill-board. They are not injured by high-pressure steam. Many other substances may be used, according to circumstances, for filling the pores, previous to pressure—as fat, oils, boiling coal-tar, wax, &c. &c.

It is worthy of remark, that the substance proposed being used for all the above processes, is the worst turf for burning; so that the material which is worst, and nearly valueless as fuel, is the best and most valuable, by a fortunate coincidence, for manufacturers. If, therefore, as there is reason to believe, the lower strata of turf can, by certain modes of charring, be made a valuable fuel, and the upper and more recent strata are used for the purposes of the various manufactures above adverted to, there is strong ground of hope that, at a future period, the bogs of Ireland, instead of being contemplated, as hitherto, as a blot and stain upon her fair and fertile champaign, may be looked upon as one of the centres of her industry, and the richest sources of her wealth.

We examined specimens of the pulp, described as being yielded from peat, at the rate of eighteen per cent. and have no hesitation in saying that it appeared to be white, pure, and perfectly suited to the manufacture of paper.

With respect to the bistre colour, we were assured, by a very competent judge, that he considered it quite eligible for the use of the artist, the house-painter, and the paper-stainer. He also spoke favourably of the mill-boards formed by the operation described; and had no doubt but that the other products from the combinations employed, such as alum, Glauber's salt, artificial camphor and ammonia, would fully answer the purposes of commerce.

Ireland, we believe, is *blessed* with two millions of acres of bog (of which 1,300,000 are susceptible of drainage and cultivation*); and if it should be convertible into so many useful

* According to Parliamentary returns: the greatest depth forty-five feet; and the average depth twenty-eight feet.—*Ed. Literary Gazette.*

articles of consumption, how prodigious must be the sources of employment and improvement which it will open to the view of the statesman and philanthropist.*

NEW MINIM MEASURE.

At a late meeting of the Medico-Botanical Society, a new minim measure was exhibited, the invention of a gentleman of the name of Alsop, residing in Sloane Square, Chelsea. It consists of a graduated glass tube, with a large opening at the upper end, and a smaller or capillary one at its lower extremity. It is worked by a piston, which fits closely to the sides of the tube, but does not come down close to the lower orifice, there being, therefore, a column of air between it and the opening. In order to use it, the lower end is immersed in the fluid of which some minims are required, and the piston pulled up; the column of air rises also, and a vacuum being thus caused the fluid enters. It is now to be examined, and if too much fluid has entered, depressing the piston gently will enable the operator to expel a few drops, until he has obtained the required quantity. If there be too little, he must of course reimmerse it, and repeat the proceeding just described. The advantage of the piston not reaching to the lower orifice is, that a column of air is left between it and the opening, which rises when the instrument is used, intervening between the fluid and the lower end of the piston, and thus prevents any of the medicine adhering to it, which in some cases, as where hydrocyanic acid, &c. are employed, might be injurious. The instrument is cleaned in the same way that fluids are measured, by drawing up a quantity of water into it.†

OBSERVATIONS ON THE THEORY OF RESPIRATION.

By William Stevens M. D., D. C. L.—Communicated by W. T. Brande, Esq., F. P. R. S., to the Royal Society.

From the fact that no carbonic acid gas is given out by venous blood when that fluid is subjected to the action of the air-pump, former experimentalists had inferred that this blood contains no carbonic acid. The author of the present paper contends that this is an erroneous inference; first, by showing that serum, which had been made to absorb a considerable quantity of this gas, does not yield it upon the removal of the atmospheric pressure; and next, by adducing several experiments in proof of the strong attraction exerted on carbonic acid both by hydrogen and by oxygen gases, which were found to absorb it readily through the medium of moistened membrane. By means of a peculiar apparatus, consisting of a double-necked bottle, to which a set

* Literary Gazette, No. 973.

† Lond. Med. and Surg. Journal, quoted in the Athenæum, No. 398.

of bent tubes were adapted, he ascertained that venous blood, agitated with pure hydrogen gas, and allowed to remain for an hour in contact with it, imparts to that gas a considerable quantity of carbonic acid. The same result had, indeed, been obtained, in a former experiment, by the simple application of heat to venous blood confined under hydrogen gas; but on account of the possible chemical agency of heat, the inference drawn from that experiment is less conclusive than from experiments in which the air-pump alone is employed. The author found that, in like manner, atmospheric air, by remaining for a sufficient time, in contact with venous blood, on the application of the air-pump, acquires carbonic acid. The hypothesis that the carbon of the blood attracts the oxygen of the air into the fluid, and there combines with it, and that the carbonic acid thus formed is afterwards exhaled, appears to be inconsistent with the fact that all acids, and carbonic acid more especially, impart to the blood a black colour; whereas the immediate effect of exposing venous blood to atmospheric air, or to oxygen gas, is a change of colour from a dark to a bright scarlet, implying its conversion from the venous to the arterial character: hence the author infers that the acid is not formed during the experiment in question, but already exists in the venous blood, and is extracted from it by the atmospheric air. Similar experiments made with oxygen gas, in place of atmospheric air, were attended with the like results, but in a more striking degree; and tend, therefore, to corroborate the views entertained by the author of the theory of respiration. According to these views, it is neither in the lungs, nor generally in the course of the circulation, but only during its passage through the capillary system of vessels, that the blood undergoes the change from arterial to venous; a change consisting in the formation of carbonic acid, by the addition of particles of carbon derived from the solid textures of the body, and which had combined with the oxygen supplied by the arterial blood: and it is by this combination that heat is evolved, as well as a dark colour imparted to the blood. The author ascribes, however, the bright red colour of arterial blood, not to the action of oxygen, which is of itself completely inert as a colouring agent, but to that of the saline ingredients naturally contained in healthy blood. On arriving at the lungs, the first change induced on the blood is effected by the oxgen of the atmosphric air, and consists in the removal of the carbonic acid, which had been the source of the dark colour of the venous blood; and the second consists in the attraction by the blood of a portion of oxygen, which it absorbs from the air, and which takes the place of the carbonic acid. The peculiar texture of the lungs, and the elevation of temperature in warm-blooded animals, concur in promoting the rapid production of these changes.*

* Proceedings of the Royal Society.

INK PERMANENT IN THE AIR.

M. Braconnot, of Nancy, has published a recipe for ink, which he says answers extremely well in Botanic gardens, and open or wet situations, where names are required to be preserved permanently.

Take of	Verdigris	1	part
	Sal ammoniac	1	part
	Soot	½	part
	Water	10	parts

Mix the powders in a glass or porcelain mortar, adding at first one part of water, in order to mix them well, then add the remainder of the water. Shake the ink well from time to time. When it is to be used, we must write with it upon a plate of zinc, and after some days, it becomes hard, and cannot be obliterated by atmospherical influence or by rubbing. The ink may be tinged with any colour, by substituting for the soot some mineral colouring matter.*

ON THE IMMEDIATE TRANSMISSION OF CALORIFIC RAYS THROUGH DIATHERMAL BODIES.

By M. Macedoine Melloni.†

At the last meeting of the British Association for the Advancement of Science, Mr. H. Hudson and Mr. Powell furnished several communications on radiant caloric. After having cited some of my experiments on calorific transmission, these ingenious philosophers endeavoured to explain them by hypotheses which in my opinion can no longer be sustained in the present state of science. I wish to direct inquiry to a subject which by its intimate connexion with the fundamental properties of one of the principal agents of nature, appears to me worthy to engage our attention.

For a long time the immediate transmission of terrestrial radiant heat by transparent substances, both solid and liquid, has been denied; and the opinion has become prevalent that we see in experiments of this kind only an effect of the heat absorbed by the body submitted to the calorific radiation. Hence, from the first researches which I undertook upon the immediate transmission of heat, I have endeavoured to render my observations entirely independent of the heating effect proper to the diaphanous plate submitted to experiment; and I succeeded in this by a very simple arrangement, which consists in diminishing as much as possible, in the first instance, the heating effect of the plate, by placing it at a considerable distance from the source, and then in rendering its action upon the thermoscope *wholly insensible*, by removing the instrument to the requisite distance

* Annales de Chimie, quoted in Thomson's Records, No. 11.

† Communicated by the Author, through Michael Faraday, Esq., D.C.L., F.R.S.

from the plate itself. But in order to experiment under these circumstances, it is clearly necessary to employ an extremely delicate thermoscope, such as well-constructed thermomultipliers, otherwise the feeble rays of heat, direct or transmitted, which arrive from the distance at which the instrument is fixed, would produce no perceptible effect. Further, when any one wishes to make experiments on the transmission of caloric, he may always assure himself that the condition above mentioned is fulfilled. For that I have given four different proofs: the following is the one which is inserted in the Report on Radiment Heat made by M. Biot to the Académie des Sciences; it will soon be seen why I have preferred this proof to the others.

Let us suppose the source of heat, the body, and the thermomultiplier in the proper positions. The plate of the diathermal substance employed will then be applied against the central opening of the metallic screen: it will immediately transmit a certain quantity of radiant heat, which will penetrate into the cylindrical covering of the pile placed at a distance behind the screen, and directed upon the prolongation of the line drawn from the source to the centre of the opening: the indicating needle of the galvanometer connected with the thermoelectric pile will be set in motion, and will take a greater or a less deviation according to the diathermaneity (*diathermancite*) of the substance of which the plate consists. After having noted this arc of deviation, let the pile be removed by degrees from the direction of the immediately transmitted calorific rays, taking care always to hold the opening of its covering turned toward the plate, the distance of which from the pile ought not to vary. We shall then see the deviation of the galvanometer diminish gradually, and be reduced exactly to zero, when the covering of the pile shall have entirely left the conical space occupied by the pencil of emergent heat; which supplies the most complete proof that the heating effect due to the plate itself does not exercise the least perceptible influence on the actual conditions of the apparatus.

To render the force of this demonstration still greater, we may bring the pile several centimetres toward the plate, while we remove it from the immediate direction of the rays. We may also turn the plate upon its vertical axis, and place it opposite the opening of the instrument removed from the calorific cone, without the least deviation being manifested by the galvanometer in either the one case or the other.

It is thus decisively proved by this experiment, that the heat from the source traverses the plate, *preserving its radiant form;* that the calorific rays are propagated beyond the plate *in their original direction only* (*dans le seul sens de leur direction primitive*); and that *all the effect produced*, in the case in which the axis of the pile is in front of the central opening of the screen, is attributable to the action of the radiant heat trans-

mitted immediately by the plate. This mode of demonstration being independent of the nature of the rays, is equally applicable to dark or luminous radiant heat.

Now Mr. Hudson, in removing his thermo-electric pile out of the direction of the calorific rays emitted by a vessel full of hot water, finds that the needle of the galvanometer remains at zero when the opening of the screen is free: but he still observes a very sensible deviation in the case in which the opening is closed with the diaphanous plate. What must we conclude? Evidently, that the circumstances under which Mr. Hudson experimented were by no means favourable for studying the immediate transmission of radiant caloric through solid bodies; and yet that philosopher cities his results as facts tending to prove that there is no immediate passage of simple heat through that class of bodies. His induction, although presented under a doubtful form, does not appear to me permissible.

Mr. Powell performed in 1825 a very beautiful experiment upon radiant caloric; it consists in proving that the ratio of calorific absorption of a white surface to that of a black one is not the same for the rays proceeding directly from the source, and for the rays transmitted by a plate of glass. The sources of heat employed by Mr. Powell were an Argand lamp and iron heated to a bright red. I have had occasion more recently to verify this fact, which holds good not only with the glass, but with all diathermal substances, rock-salt excepted. In order to explain this phenomenon, as well as the old experiments of calorific transmission, Mr. Powell admitted that flame and incandescent metals radiate *two kinds* of heat, the *luminous* and the *obscure*, the first of which alone is capable of traversing the glass, whilst the second is entirely absorbed by that substance. He even now thinks that the entire series of my experiments may be explained on this supposition which he without doubt has modified, in conceding that the interception by solid bodies in general is not a distinctive character of the non-luminous heat, since, in certain cases, it traverses these bodies with the same ease as the most luminous heat. If Mr. Powell alludes to experiments analogous to his own, that is to say, the series of observations which have been made with the pile having one of its faces whitened and the other blacked, I am of his opinion; but I differ from him totally if he admits that the hypothesis of two heats suffices to explain all the facts relative to the transmission. I will limit myself to citing some results which appear to me decisive. If we expose a common plate of glass of one or two millimetres in thickness to the calorific rays of Locatelli's lamp emerging from a black opake glass, then to the immediate radiation of a plate of copper heated to 400° [Cent.?], and finally to the heat emitted from a vessel full of boiling water, we find that its transmission is 70·100 to 80·100 of the incident heat in the first case, 12·100 to 15·100 in the second, and 0 in the third.

Now here the three radiations *consist exclusively of non-luminous heat;* and yet their transmissibility across the same plate is so different, that nearly all the incident rays of the heat emitted by the lamp pass immediately, while those of the heat emitted by the boiling water are completely absorbed. It is scarcely necessary to add that we should have other transmissions if we took calorific sources of different temperatures from those I have just cited. *There are, then, several kinds of dark heat,* as there undoubtedly exist several kinds also of calorific rays in the heat which ordinarily accompanies light.

Paris, Nov. 15, 1835. MACEDOINE MELLONI.

NEW VOLTAIC BATTERY.

PROFESSOR Faraday's Tenth Series of "Experimental Researches in Electricity," relates altogether to the practical construction and use of the voltaic battery. Guided by the principles developed in former series, the author concluded that in voltaic instruments in which the copper surrounded the zinc, there was no occasion for insulation of the contiguous coppers, provided they did not come into metallic contact: and therefore in the construction of some new instruments he interposed paper only between the coppers instead of the usual insulating plate of porcelain or glass. The battery thus constructed is essentially the same with Dr. Hare's; and the author recommends even his form of trough for the purpose of putting the acid on to, and moving it from the plates. By attending to certain points described, as many as 40 pairs of plates could be packed into a space not more than 15 inches in length, and thus a very portable, and, at the same time, powerful and convenient trough might be obtained.

In comparing this form of trough with others, the author used acids of constant strength, took note of their quantity, allowed them to act in the troughs until the power of the apparatus had nearly ceased, estimated the quantity of effect by his volta-electrometer, and then estimated the quantity of zinc in the battery employed in producing the effect by the results of an analysis of a given portion of the exhausted charge. In this way it was easy to tell how much zinc was dissolved from any one plate, or from all the plates, and to compare it with the quantity of water decomposed in the volta-electrometer. Thus with a perfect battery of 40 pairs of plates, an equivalent of water decomposed in the volta-electrometer would be the result of the solution of an equivalent of zinc from each zinc plate, or forty equivalents in the whole; but with a battery not so perfect, a greater proportion of zinc would be dissolved by the acid in the cells.

When the new battery was thus compared with that of the

* Philosophical Magazine, No. 42.

ordinary form, it was found to have greatly the advantage. Thus, with 40 pairs of plates, the former lost 2·21 equivalents at each plate, and the latter 3·54. With 20 pairs of plates, the former lost 3·7 per plate, and the latter 5·5. With 10 pairs of plates, the former lost 6·76 per plate, and the latter 15·5. The author refers to two difficulties still existing in the construction of the battery, but considers its value so great as to deserve receiving that degree of attention by the application of which these difficulties may be removed.

The author then investigated many other practical points in the use of the battery, ascertaining the influence of various circumstances in the manner already described. Thus he found nitric acid to give a higher result of voltaic action than sulphuric or muriatic acid; the quantity of zinc dissolved in order to produce decomposition of an equivalent of water being only 1·85 per plate when nitric acid was used, 3·8 when muriatic acid was used, and 1·66 when sulphuric acid was employed. The acid which he afterwards used as the best for ordinary purposes consisted of 200 water, 4·5 oil of vitriol, and 4 nitric acid.

The mode of proof adopted by the author was of course independent of the strength of the acid: as was shown by making experiments with the same acid at very different strengths; thus when nitric acid was used, and strengths were as 1, 2, and 4, the proportion of zinc dissolved was very nearly the same for the water decomposed. The same result was obtained when sulphuric acid was employed.

The different circumstances of uniformity of charge—purity of zinc—foulness of the zinc plates—new and old plates—vicinity of the copper and zinc—doubling of the copper—first immersion of the plates—number of plates—size of the plates and simultaneous decompositions—were then considered, and such of them as would admit of experimental comparison in the manner already described were put to this test.*

COMPARISON OF THE TWO THEORIES OF ELECTRICITY.

At the Royal Institution, on April 3, Dr. Ritchie stated, that at present there are two theories which have been proposed for the explanation of electrical phenomena. One which is the simplest theory, supposes that they depend upon the existence of a fluid universally diffused through matter and space, the particles of which repel each other inversely as the square of the distance. If we abstract a portion of this fluid from a body, the latter becomes negatively electric: while if we add a portion, we produce the phenomena exhibited by positive electricity.

Another theory considers electricity to be a compound substance, consisting of two elements, positive and negative electricity. None of the phenomena are observed until this fluid is

* Philosophical Magazine, No. 41.

decomposed, and then a portion of it goes to the attracted body.

Upon this supposition we can best explain why divergence of the gold leaves in an electrometer should take place in vacuo. Perhaps, the fluid may be the ether, to which the phenomena of light seem attributable. But unless it be a compound fluid, it is not possible to explain the fact, that when a vessel, in which there is a small aperture at the bottom is filled with water, when it is attached to either conductor of the machine, there is formed a regular stream through the aperture.

Now, if there were two fluids the same appearance should not be exhibited at both conductors. When a bit of wax is attached to either conductor, heated, and then the machine set in motion, the wax is thrown upon white paper held below it, in the form of a beautiful thin film. It is difficult to explain the fact, that when we place a card between two fine points, and discharge an electric jar through them, the card will be pierced opposite to the negative point. The reason perhaps is, that the paper is a better conductor of one of the elements of the fluid than of the other. The card on each side presents the same appearance, which leads to the conclusion, that a fluid has passed through from both sides.

According to the theory of Franklin, the actual particles of matter repel each other, which is contrary to the law of gravitation.

By considering electricity as a compound body we can explain also the electrophorus.

In order to confirm the idea of the existence of two elements, we can by a beautiful experiment separate one element from the other.

If we place two conductors united by their contact with fine points, at a considerable distance, from the conductor attached to the machine, charge the machine, and then suddenly remove one of the separate conductors to the electrometer, we obtain a divergence in the gold leaves of the latter. To determine the nature of the electricity which has thus been separated is easily accomplished, by means of a glass rod excited, or a substance covered with a resinous coating.

Dr. Ritchie suggested that by a modification of the galvanometer, base coin may be readily detected. A bad sixpence which he submitted to examination produced a very rapid deviation in the needle. He is of opinion that 1·1000 of copper mixed with silver might be by this method appreciated.

Dr. Ritchie endeavoured to afford an explanation of Dr. Faraday's experiment, in which, the spark was elicited in a long wire, by the consideration, that one particle of light does not communicate light. Now, in the long wire the quantity of electricity was smaller than in the short wire, but took a longer time to arrange itself.

The able lecturer exhibited an electro-magnetic machine, in which he had devised some improvements, by which combustion and decomposition can be as readily effected and more conveniently than with a voltaic pile. This affords an excellent instrument for class room experiments.*

PREPARATION OF HYDROCYANIC ACID OF UNIFORM STRENGTH.

By Thomas Everitt, Esq., Professor of Chemistry to the Medico-Botanical Society.

THE best proportions of the ferrocyanuret of potassium and sulphuric acid to be used when we want hydrocyanic acid are as follow :—

To every 212·47 grains of the crystals dissolved in about 2 fluid ounces of water, add so much dilute sulphuric acid as shall contain 120 grains of real acid, and, by conducting the distillation carefully, 41 grains of hydrocyanic acid pass off, and that I find with the first ⅓rd of the water: of course water must be put into the receiver and kept very cold. But no process for procuring a dilute solution of hydrocyanic aid, in which distillation or filtration is had recourse to, will yield an acid of uniform strength, however carefully the process may be conducted, not even, as I have proved, if the receiver be surrounded with ice. Hence the *absolute necessity* of assaying in all such processes the ultimate product, either by the nitrate of silver or the peroxide of mercury method; the first is to be preferred: we have the great advantage that any error committed in collecting, drying, and weighing, is reduced to 1·5th in estimating the quantity of real acid, 100 grains of the cyanide of silver corresponding to 20·38 of hydrocyanic acid.

In addition to the very elegant application of the nitrate of silver for detecting the presence of free hydrocyanic acid in its passage as vapour from a dilute solution, or any plant containing the acid (thus, masticate a bitter almond, put it in a watch glass, and cover it with a bit of glass, on the under surface of which a drop of dilute nitrate of silver is placed; in a few minutes the cyanide of silver is formed,—an experiment which may serve as a class illustration of the extreme volatility of the substance), recommended by Mr. Barry in the London and Edinburgh Philosophical Magazine, vol. iv., p. 151. (or *Repertory*, New Series, vol. i., p. 178–181, in the number for March, 1834). Mr. Barry has also put me in possession of a means as elegant for the testing of the presence of minute quantities of hydrochloric or sulphuric acid in hydrocyanic acid, viz. Put some of the acid on a watch glass, add 2 or 3 drops of *liquor ammoniæ*, put the glass on the sand bath and evaporate to perfect dryness, when all ammonia and hydrocyanic acid pass off, leaving only, if any hydrochloric or sulphuric acid be present, a little hydrocholorate or sulphate of ammonia behind; a drop or two of distilled water will dissolve these, and by nitrate of silver added to one half, and nitrate of barytes to the other, the presence or absence of the above acids will be determined. If the hydrocyanic acid be quite pure, the watch glass, after evaporation, is scarcely soiled, and water dissolves nothing: this method is far preferable to that by means of carbonate of lime usually recommended.

* Thomson's Records, No. 6.

In a paper which I read to the Medico-Botanical Society, on Thursday, December 9, 1834, on the methods of assaying medicinal hydrocyanic acid, I stated that I had examined samples of the acid procured from various shops in town, and that the frightful difference of strength had induced me to make the results known, with a view of calling the attention of the medical profession to the evil. Thus, samples from Allen, Hanbury and Co. yielded 5·8 per cent.: from Apothecaries' Hall, at different times, from 2·1 to 2·6 per cent.; and from several sources I found acid containing only 1·4 per cent. These samples I procured from the several shops personally, and asked for Scheele's strength. They were assayed within 24 hours after they were in my possession, both by the nitrate of silver and the oxide of mercury method, and the results in no cases varied more than 1·10th of a grain from each other. Now it is true we have no fixed standard, and therefore it is impossible to say whether Allen and Co.'s is too strong or the others too weak; but thus much is certain, that if a medical man were pushing the exhibition of hydrocyanic acid gradually to a maximum dose, the prescriptions being carried to a shop where the acid had only 1·4 per cent., and then, by some accident or other cause, taken to where Allen's acid was used, a sudden and, I fear, a fatal increase would be the result, for more than a triple quantity would be taken. For the possibility of a fatal accident I need only refer to the case of seven individuals near Paris being killed by a slightly increased dose, recorded in all the medical periodicals a few years since.

On the same evening I called the attention of the members of the Medico-Botanical Society to the method for procuring medical hydrocyanic acid recommended by Dr. Thomas Clarke, by cyanide of potassium and tartaric acid; a method which can now be employed by any one, since Mr. Laming has brought into the market a very pure salt. From very numerous trials, I find that the procuring of this salt, the cyanide of potassium perfectly pure, must be expensive, and I have never been able to procure it strictly in this state without using alcohol to crystallize it from: and many chemists, I find (see Mr. Barry's paper above alluded to) object to it, from its being so excessively deliquescent, and hence rather unmanageable, and also to the liability of this highly poisonous salt being mistaken for other white salts on their counters. This latter objection, I must say, is hypercritical: if people will be careless there is no means of preventing mistakes, and I conceive the objection of Mr. Barry applies with tenfold force to many arrangements of a druggist's shop, where we often see tincture of opium flanked right and left by other dark tinctures; and who that has manipulated has not caught himself laying hold of, and using one acid, &c. for another, when the mind is also at work?

I have made many trials as to the practicability of applying the cyanide of silver and dilute hydrochloric acid for procuring medical hydrocyanic acid. The cyanide of silver presents many advantages: it is perfectly stable, being neither affected by light nor mosture; its purity can be very easily ascertained, and every five grains of it will yield one grain of acid. It can be procured by conducting the vapour from the process described above into a pint of water, holding 255 grains of nitrate of silver, washing and drying at 212°. It yields 201·6 grains of white cyanide. I should recommend that the bottle containing this salt be accompanied by a small stoppered phial with dilute hydrochloric acid of such strength, that 1 minim will exactly decompose 1 grain of the

cyanide: thus, suppose one corked phial having 200 grains of cyanide, with one half-oz. stoppered bottle with hydrochloric acid of specific gravity 1·129, this would be enough to make five fluid ounces of dilute hydrocyanic acid of the Dublin strength, if the following formula be followed:—Into a phial capable of holding rather more than 1 fluid ounce, put 40 grains of the cyanide, add 7 fluid ounces, 20 minims of water, and 40 minims of the dilute hydrochloric acid; cork closely, shake several times for the first quarter of an hour, set aside to allow the chloride of silver to fall, decant the clear liquid into another bottle to be preserved for use: every fluid drachm will contain 1 grain of real hydrocyanic acid.

The only objection I had *à priori* to this process was the liability of a little free hydrochloric acid remaining in the solution, since all books echo that the presence of a minute quantity of the mineral acids very much hastens the decomposition of this acid: a statement perfectly opposite to fact, at least as far as concerns hydrochloric acid. I prepared 4 ounces of hydrocyanic acid perfectly pure by distillation of chalk; to 2 ounces I added 5 drops of hydrochloric acid; the other 2 ounces in another phial were left perfectly pure, both inverted and placed in a glass case so as to have diffused light during the day. After three weeks the pure acid had become quite brown, and a considerable quantity of solid deposit had formed; the other remained quite limpid and colourless, and, on actual trial, was found to contain 19·20ths of the acid which it had at first. Mr. Barry also informed me that his fourteen years' experience led to the same result; and that being aware of this, he adds purposely a little hydrochloric acid to all his medicinal acid. Perhaps some may object to the price of the preparation: a case containing the two bottles with 200 grains of the cyanide would leave one-half profit if sold for five shillings; this brings an ounce of acid to one shilling, and where so small a quantity is used, surely this cannot be a very weighty objection, if a uniform article can be secured.*

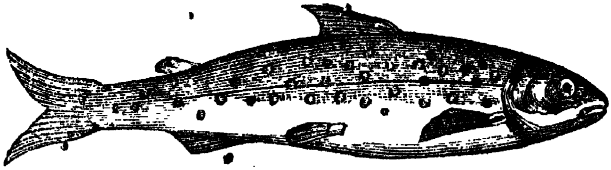
* Abridged from the Philosophical Magazine, No. 32, in the Repertory, No. 19.

NATURAL HISTORY.

ZOOLOGY

THE GRAVELLING OF THE TAW.

THE fish represented in the cut was caught, in April, 1834, in the river Taw, about four miles above Barnstaple, in the north of Devonshire; below which town that river, after uniting with the Torridge, enters the Bristol Channel at Barnstaple Bay. This fish, which is there called the gravelling, from its affecting the gravelly shallows, abounds in the Taw from March until the end of May, when the first high tides carry them to the sea; after which not one is to be found. At this time they are full of roe. The fishermen on the Taw are quite sure that they are correct in stating it to be the young salmon; and the fact, they say, has been ascertained by catching the fish, and returning it to the water with a piece of wire inserted in the back fin; and the same fish, the following year, grown to the size of a large salmon, has been taken with the wire still remaining in the fin. The drawing is of the natural size [The drawing was 7¼ inches long, from the tip of the snout to the tip of the longest rays of the tail; and 1¼ inch in breadth, measured opposite the dorsal fin] of a fine gravelling, weighing about 2 ozs. It is a beautiful



fish, having the crimson spots of the trout; but is longer and more elegantly shaped, and the tail more forked than that of a trout of the same size. They die soon after being caught; and, as the moisture upon them dries, they become of a glossy blue colour. They are strong in proportion to their size; and afford the young angler excellent sport, taking the fly eagerly, particularly with a gentle [larva of the flesh fly] at the point of the hook.

Many years ago, as we learn from Izaak Walton, a fish, which he calls the skegger trout, used to abound in the Thames: he speaks of catching them abundantly near Windsor. It is

now but rarely seen; probably owing to the locks, and the impurities of the water attendant on the dense population residing on its banks. However, in May, 1830, when fishing between Taplow and Marlow a fisherman caught a skegger, the first he had seen for many years. He was equally sure with the Barnstaple fishermen, that this was a young salmon; it certainly resembled the gravelling in some points, having the bright crimson spots; but it was rounder, and the tail less forked. Mr. Rennie, in a note to his edition of *Walton's Angler*, thinks the skegger is the same as the par of the northern streams, and a peculiar species. Pennant (*British Zoology*, iii. 405,) says that the par abounds in the Wye in September. Now, the gravelling and skegger disappear in the Taw and the Thames before that period; and Walton says that the latter sometimes grows as large as a herring: therefore the gravelling seems a different fish from the par and skegger; never attaining such a size, and disappearing, that is, migrating to the sea, long before September. The writer found the gravelling in two other rivers in Devonshire; namely, the Yeo, which empties itself into the Taw at Barnstaple; and the Exe, near Exeter.*

PRESERVATION OF LEECHES.

A. Voget, in a notice inserted in the *Pharmaceutische Zeitung*, observes, that he has been in the habit of adding a small quantity of powdered crab's eyes, to the water in which he keeps leeches. This powder of course sinks, forming in the botton of the vessel a thin stratum, in which the leeches seem to take the greatest pleasure, creeping about on it, and thus cleansing the surface of their skins, and getting rid of the mucous threads and flocculi, with which they so soon become encumbered, when in a state of captivity.

Cavaillon, Chevallier, and Moreau de Jones, have all borne witness to the good effect of mixing *charcoal* with the water in which leeches are transported from one distant place to another. In cases where it is necessary to carry them during a long sea voyage, the inside of the vessel should be well *charred*, and some very finely powdered charcoal should be added to the water. Cavaillon prefers for this purpose *animal charcoal*, as it possesses much stronger antiseptic powers than the vegetable. It was by means of charring the casks and adding some charcoal to the water, that the French succeeded in conveying, in health and vigour, a considerable number of the fish called gorana, from the isle of Bourbon to Martinique.

Doctor Kluge, of the Charite, in Berlin, made some interesting experiments, on the best means of preserving leeches.—From

* Magazine of Natural History, No. 45.

his researches, Dr. Heyfelder has been led to recommend a mixture of three parts of rectified spirits, four parts wine vinegar, and twenty-four parts water. The leeches are to be placed in this mixture, and are to be left in it a little less than five minutes, after which they are to be washed with fresh river water, and to be put into a vessel for keeping. Leeches that have been used are likewise served in this manner.*

DEERS AND ANTELOPES.

In the Zoological Section of the British Association, at their last meeting, Dr. Jacob read a paper on the infra-orbital sinuses or *larmiers*, as they were called by the older French naturalists, in deers and antelopes; suggested by a recommendation of the Committee of this Section, at the Cambridge meeting, to investigate the subject. These sinuses are follicles or sacs capable of admitting the end of the finger, existing below the inner canthus of each eye. Dr. Jacob shows that they are not receptacles for the tears, as the term *larmier* implies: the gutter which exists in some from the eye to the cavity, being in many species inadequate for the passage of the tears, and the animal inspissated residuum, found in the sac, not being such as should remain after the evaporation of that fluid. He explains satisfactorily the statements of the Rev. Gibert White and Major Hamilton Smith, that these sacs communicate with the nostrils, by showing that air may be without difficulty in those animals forced from the nostrils through the *puncta lachrymalia*, which those observers supposed to come through the sacs or sinuses, which are altogether impervious. In fact, it appears that there can be little doubt that these sacs are follicles for the secretion of an odoriferous material, destined in these animals for the same purpose for which similar secretions are provided in different parts of other animals, as on the side of the head in elephants, the back of the peccary, the face of certain bats, the belly of the musk, and the numerous præputial and anal glands of others. This is particularly exemplified by the existence of a peculiar black secretion, which exudes in large quantity from the infra-orbital sinuses in the antelope grimmea, and in the existence of solid masses, like indurated ear-wax in old stags.†

YOUNG OF THE COMMON LOBSTER, AND TRANSFORMATIONS IN CRUSTACEOUS ANIMALS.

By T. Brightwell, Esq., F. L. S.

In the beginning of July last (1835), I procured about two ounces of the eggs of the common lobster; taken by some fishermen, at Sherringham, near Cromer, from what they term a

* Dublin Journal of Medical and Chemical Science, No. 22. † Ibid.

sick lobster, that is, one about to cast its spawn. The whole, having been put into spirits of wine, were of a red colour, except the eyes, which had the appearance of a large black spot in each egg. On opening an egg with a needle, the young lobster was immediately developed, and at the same time a strong colouring liquor exuded from the egg. Among the eggs were a few specimens of the young lobster. Their extreme delicacy and tenderness rendered it almost impossible to dissect them, but they displayed themselves very beautifully in water, and the extremities might thus be distinctly seen, under the microscope. Blotches of colour were visible in the claw, and upon various parts of the body. The eyes appeared, in this early state, sessile. The double antennæ were perceptible, the large claw was distinctly and perfectly formed, and the second leg, with the terminal claw, well made out. The other legs appeared imperfectly formed; and to be either very numerous, or mingled with transparent skin-like appendages, having the appearance of the skins of legs, cast off in moulting. The tail was well developed, and was distinctly perceived, even in those young which were forced from the egg with a needle. Two specimens of the young, which appeared double, were found, being strongly united together at the head.

Mr. Travis, a surgeon of Scarborough, clearly alludes to this state of the lobster, in his letter to Pennant. (See *British Zoology*, vol. iv. p. 12.) He says, "Though the ova be cast at all times of the year, they seem only to come to life during the warm summer months of July and August. Great numbers of them may then be found, under the appearance of tadpoles, swimming about the little pools left by the tides among the rocks, and many also under their proper form, from half an inch to four inches in length.

Mr. J. V. Thompson, in a letter addressed to the editor of the *Zoological Journal*, xix. 383, after stating that he has ascertained "the newly hatched animal to be a Zoe," in all our most familiar native genera of the Decapoda, and including the genus Astacus, has stated that, "with regard to the lobster, I can aver, that it does actually undergo a metamorphosis, but less in degree than any of the above enumerated genera, and consisting in a change from a cheliferous schizopode to a decapode; in its first stage, being what I would call a modified Zoe, with a frontal spine, spatulate tail, and wanting subabdominal fins; in short, such an animal as would never be considered what it really is, were it not obtained by hatching the spawn of the lobster." How far the young lobster is zoeform, may be seen on a comparison of it with the figure of the Zoe.*

Mr. Thompson describes the young as "cheliferous," or claw-bearing; but this term applies as well to the adult lobster as to the young one.

* Magazine of Natural History, No. 49, p. 275.

"Schizopode" or split-legged. Two of the feet, at least, are perfectly formed; whether the others are correctly described as schizopodiform, I cannot determine.

"A frontal spine." I could not perceive any spinous process whatever about the head or thorax: the head has, I think, a more larva-like appearance than any other part. The adult lobster has a rostrum, or frontal spine, forming part of its specific character.

"Spatulate tail;" that is, a tail broad and round at the point, and narrow at the base. This description does not materially vary from the tail of the adult.

"Wanting subabdominal fins." Whether the young have these, I cannot determine, the imperfect developement of the minor legs rendering it almost impossible to do so.

The general appearance of the young animal is, I think, much more nearly that of the perfect lobster than Mr. Thompson has stated.

The Freshwater, or River, Crawfish, or Crayfish. Again, Mr. Thompson has intimated, in the letter above quoted, that some peculiarity in the crawfish must have escaped M. Rathke, and that he has erroneously stated that it leaves the egg in a perfect state; but subsequent observations all confirm M. Rathke's opinion. I have myself had several fine specimens of the river crawfish brought to me from the neighbourhood of Mattishall, Norfolk, where it is rather plentiful. Several of the females had eggs, and young ones just hatched under the tail. The appearance of these young ones perfectly agrees with the description given by M. Rathke; no difference whatever being perceptible between their form and that of the perfect animal. The eggs had tail-like appendages.

On the whole, whatever differences may exist between the young and adult state of some of the decapodous Crustacea, it can hardly be doubted that Latreille's character, "nascunt parentibus omnino fere similia," will at least apply to some of them; namely, to the mountain crab, which the Rev. L. Guilding states certainly leaves the egg perfect; to the Porcellana; to the river crawfish; and to the common lobster, with the qualification Latreille has given.

On the other hand, the Rev. Mr. Guilding confirms Mr. Thompson's statement as to the fact that some species of crabs undergo metamorphoses; when he states that he has "seen a bay, a mile in length, covered with myriads of little dead crabs, bearing formidable spears, such as Mr. Thompson has figured, which had been washed on shore before their metamorphosis. From their incredible numbers, they were, probably," Mr. Guilding says, "immature Paguri."

As to the sessile-eyed Malacostraca, some of them, also, appear to leave the egg perfect. Olivier, (probably following De Geer and Geoffroy), in his description of the genus Gam-

marus *Lin.*, says, "These insects (as he calls the *crevettes*) *do not undergo any transformation; and they have, at their first appearance, the form which they preserve throughout life;* but they change their skin many times, according to their growth. The cast skin shuts to again so closely as to have the semblance of the insect itself." (*Encyclopedie Methodique, Insectes*, vol. vi. p. 183.)

Mr. Montagu, also, in the *Lin. Soc. Trans.*, vii. p. 67, describing Cancer Phasma (Caprella *Leach*), says, "While examining a female in a watch-glass of sea-water, under a microscope, we were agreebly surprised to observe not less than ten young ones crawl from the abdominal pouch of the parent; all perfectly formed, and moving with considerable agility over the body of the mother; holding fast by their hind-claws, and erecting their heads and arms."

On the other hand, Dr. Coldstream has given us a figure of what he calls the *fœtus* of the Limnoria terebrans. In the *Edinburgh Philosophical Journal*, xvi. 325, he says, "Within the sac there are generally found six or seven young Limnoriæ: in some individuals only five, in others nine. They have come under my observation always in an advanced stage of developement; but I have never seen them give any signs of life. The head, and the other five anterior segments, are larger, proportionally, than in the adult. The antennæ and eyes are almost completely formed, although the articulations of the former are not distinctly seen; the colour of the eye is nearly as deep as in the adult. The other appendages hang loosely from the inferior surface: all present the appearance of simple tubiform organs. Even the jaws and the branchiæ can scarcely be distinguished from the legs."

There is, evidently, a wide field open in this subject for investigation.*

THE ITCH MITE.

Many persons suppose that there is no foundation for the notion that itch is produced by the presence of a parasitical insect, yet there is nothing extraordinary in such an occurrence. Animals without number derive their existence from other animals only, nestling on their surfaces, burrowing in their flesh, or hatching in their skins. Man is preyed upon by the flea, the bug, two species of louse, intestinal worms, hydatids, guinea worms, and others. Even the very insects have their parasites, as any one may see on the dung beetle; and Butler's joke, that fleas have other fleas that bite them, these others still *ad infinitum*," is not so extravagant as might be supposed. The existence of the itch mite has been established on the authority of Cestoni, Bonomio,

* Magazine of Natural History, No. 53, see also the volume for 1835, for other important papers on this inquiry.

Redi, De Geer and others. M. Dugès has obtained the insect in so perfect a state that he has been enabled to represent it in a plate which is copied into the present number of this Journal. It appears to the naked eye as a white point, but its beak or sucker and limbs are red; it burrows beneath the cuticle, forming tortuous canals, in which the animal is to be sought, not in the pustule. M. Dugès suggests the application of turpentine as a cure with good reason. The insect belongs to the family acarus, being a species of the genus *sarcoptes, sarcoptes scabiei humani.**

INHABITANTS OF SHELLS.

On June 18, were read before the Royal Society, "Some Remarks on the difficulty of distinguishing certain Genera of Shells; and on some Anomalies observed in the Habitations of certain Species of Mollusca." By John Edward Gray, Esq., F.R.S.

In opposition to the opinion of those geologists who consider all shells of the same form and character as having been inhabited by one genus of animals; that all the species of a genus live in similar situations; and that all the species of fossil shells, appearing from their character to belong to some recent genus, have been formed by animals which in their living state had the same habits as the most commonly observed species of that genus,—the author proposes to show, first, that shells having the appearance of belonging to the same natural genus are sometimes inhabited by very different animals; and, secondly, that some species of shell-bearing molluscous animals live in different situations from the majority of the species of the genus to which they belong, or even have the faculty of living in several different situations. Thus, although the animals inhabiting the shells belonging to the genera *Patella* and *Lottia* are extremely dissimilar in many essential features of their organization, the shells they form cannot be distinguished from one another by any known character. In other instances, when the animals are very different, the distinctive characters of the respective shells belonging to them are so slight as to be insufficient for the purpose of classing them under separate species; and this difficulty of discrimination must be much increased in the cases of fossil shells, especially of those which have no strictly analogous forms among recent shells.

In support of the position advanced in the second part of the paper, namely, that numerous exceptions occur to the identity of habitation among all the species of the same genus of conchiferous Mollusca, the author adduces examples: 1st, where the species of a genus are found in more than one situation, as on land, in fresh and in salt water; 2nd, where one or more species

* Dublin Journal, No. 23.

of a genus, the species of which generally live in fresh water, are found in salt or in saltish water; 3rd, where one or more species of a genus, which is generally found in the sea, are, on the contrary, found in fresh water; and, 4th, where the same species of shell is found in salt and in fresh water.*

A SHOWER OF TOADS.

SEVERAL letters have been addressed to the French Institute on this subject, from persons to whose characters credit might be attached. They describe small toads or frogs to have been seen falling, and caught on an umbrella, a handkerchief spread out for the purpose, or the leaf of a shovel hat, &c. &c. Some of these young batracians hardly the size of a small nut, presented a rudiment of tail, proving, that they were very near to their period of metamorphosis. So much for the facts; as to the explanation of the phenomena, there is one, that has been generally admitted by those who admit the fact itself, viz., that the solar evaporation carries up with it the spawn of the frogs and toads contained in the water of marshes; that this spawn retained in the cloud, formed of the condensed watery vapours, is hatched there, and undergoes its changes, and is precipitated when the cloud which bears it is resolved into rain. The electricity of the clouds, would facilitate and hasten the developement of those animals.

M. Duparcque, writer of one of the above mentioned letters, attributes the phenomenon (of which he has been a witness) to the action of water-spouts. According to him, one of these whirlwinds which precede storms in the great heats of summer, in crossing marshy situations at the period of the transformation of tadpoles into frogs in fields, raise up masses of these animals, with a portion of water which they abide in; and the water-spout becoming larger, and forming a stormy cloud, will at a later period vomit them forth, with the lightning and water it contains. The carrying off these animals is facilitated by their leaving their subterranean retreats, and coming to the surface of the water on the approach of rain.

In support of this theory, M. Arago related, that when in England, Mr. Dalton told him, that he had several times collected, in a pluriometre, at the distance of six or seven leagues from the coast, sea water which had been brought thither by the wind.†

LEUCOSIS, (LEUCOPATHIA, ALBINOISMUS.)

THE pink colour of the iris and pupil of the eye in Albinos, is owing solely to the blood that is present in that organ. This is

* Philosophical Magazine, No. 39.

† Revue Medicale, quoted in the Dublin Journal, No. 19.

easily proved by killing an Albino rabbit and cutting one of its eyes out of the orbit; the vessels being thus divided, most of the blood escapes, especially when the eye is kept for a short time in water; and it then appears quite colourless both by reflected and transmitted light.

Last year, Dr. Ascherson informed me, (says the writer,) that he had seen a case of after-developement of the pigment in a boy three years old. This child had at his birth white hair and violet coloured eyes, with dark red pupils: at the end of the third year, its hair was light brown and its eyes were blue; but they had still in a remarkable degree, though less so than before, that restlessness peculiar to the eyes of Albinos. This was the only case of the kind I had ever heard of, except that communicated by Michaelis, in Blumenbach's *Medicinische Bibliothek*, vol. iii. p. 679; which, however, rests only on the uncertain authority of some peasants. Singularly enough, I had soon after the good fortune to meet with a similar case myself. In my younger days, there were two children, a brother and a sister, living near me, who presented such striking symptoms of leucosis in their eyes, hair, and skin, that they were recognised as Albinos even by non-medical persons. My attention was lately drawn to them by an advertisement I saw in the papers, in which their name occurred, and I learned that the brother had become a tobacconist; but, to my great astonishment, on going to see him, I found that his eyes had changed from violet to grey, and his hair from white to light brown, and that the susceptibility of the eyes to the light had greatly diminished. There is a circumstance in some degree analogous to this subsequent developement of the pigment of the eye, which, though much less striking, is of frequent occurrence; namely, that in children born with grey or blue eyes, they gradually become brown before the expiration of the first or second year. How far Rudolphi's statement is correct, that the secretion of the pigment of the eye is more copious in youth, than in middle age, I am not prepared to say. Desmoulins also maintains that the pigment of the eyes diminishes in old people, as is notoriously the case with that of the hair.*

METAMORPHOSES IN CRUSTACEA.

On June 18, a paper was read before the Royal Society, "On the supposed Existence of Metamorphoses in the Crustacea." By J. O. Westwood, Esq., F.L.S.

The author refers the principal modifications of form which occur during the progressive developement of animals to the three following heads; 1st, that of an animal produced from the egg in the form which it is destined to retain through life, its only change consisting in a series of moultings of the outer envelope,

* Medicinische Zeitung, quoted in the Dublin Journal, No. 19.

attended merely by an increase of size, and not by the acquisition of new organs; 2nd, when the animal, at its exclusion from the egg, exhibits the form which it continues to possess, subject to a series of moultings, during several of the last of which certain new organs are gradually developed; and, 3rd, when the form of the animal, at its exclusion from the egg, is totally different from that under which it appears at the later periods of its existence; such change of form taking place during two or three of its general moultings, and consisting, not only in the variation of the form of the body, but also in a complete change in the nutritive and digestive systems, and in the acquisition of various new organs. This last phenomenon peculiarly characterizes what is termed a *metamorphosis*.

It is the received opinion among naturalists that the Crustacea do not undergo metamorphoses, properly so called, and that the transformations they exhibit consist merely in the periodical shedding of the outer envelope. The object of the present paper is to establish the correctness of this opinion, in opposition to that of Mr. J. V. Thompson, who has laid claim to the discovery that the greater number of the animals belonging to the class Crustacea actually undergo metamorphoses of a peculiar kind, and of a different character from those of insects. Mr. Thompson's views are founded upon some circumstances which he has observed in certain animals of the genus *Zoea* of Bosc, and which have been recorded by Professor Slabber, and which led him to believe that, of these animals, some were the young of the *Cancer Pagurus*, or common crab, and others the young of the *Astacus Pagurus*, or common lobster; and these views are supposed by him to be corroborated by the annual peregrinations of the land crabs to the sea-side for the purpose of depositing their eggs, rendered necessary by the aquatic habits and conformation of the young. The author then proceeds to examine at length the arguments on which Mr. Thompson has founded these opinions, and adduces his reasons for concluding that they are erroneous, and that no exception occurs to the general law of developement in the Crustacea, namely, that they undergo no change of form sufficiently marked to warrant the application to them of the term *metamorphosis*.*

PRIVATE LIFE OF THE BURYING BEETLE.

By Rusticus.

Ever since I first wore that garment, which in this privileged country is supposed to imply that the wearer thereof is, or is to be, one of the lords of the creation, the house and premises situate to the west of Godalming, and extending from the town to the Gill property at Eshing, have been known by the name of God-

* Philosophical Magazine, No. 39.

bold's: it was there I watched the manœuveres of the burying beetle. Waring Kidd had shot a bulfinch, but it was spoiled for stuffing, and thrown down as useless by the side of the path just by the bath. It was on this bulfinch, and in this situation, that I had the pleasure of seeing the burying beetle at work.

Two days after, I was again in Godbold's; and seeing the bulfinch lie where he had been left, I lifted him up by a leg, intending to make a present of him to a fine colony of ants established a little further on. They had made many a pretty skeleton for me, and I intended to add that of a bulfinch to the store, but the buzz of a beetle round my head caught my ear; he flew smack against the bulfinch, which I was holding up by the leg, and fell at my feet. I knew that the gentleman was a burying beetle, and as I put the bird down for him, he soon found it, mounted upon it, and, after much examination, opened out his wing cases, and flew away. I will profit by his absence, to tell you a bit of his history.

The burying beetle is about an inch in length; he is black, with two bands across his back of a bright orange-colour; these bands are formed by two blotches of orange-colour on each of the wing-cases: he is a disgusting creature, though in such a gay dress, being so fetid, that one's hands smell for hours after handling him; and if he crawls on one's coat, or other garments not often washed, the smell continues for days. The whole tribe of burying beetles lay their eggs in the bodies of dead animals, which, when possible, they bury for the purpose. In Russia, where death itself does not do away with distinctions, the poor people are buried but a few inches under ground, the coffin consisting of four boards roughly nailed together, and not particularly well fitted; the operation of burying is often at the expense of the country, and therefore done from necessity, not love. This mode affords great pleasure to the burying beetles, as it saves them the labours of the gravedigger. They avail themselves of the bodies placed so nicely within their reach, and the graves are pierced with their holes in every direction; at evening hundreds of these beetles may be seen in the Russian burying-places, either buzzing about the graves, or sitting placidly at the mouths of their burrows, which lead into them.

The burying beetle in this country seldom finds so convenient a provision for him, and he is under the necessity of taking much more trouble; he sometimes avails himself of dead dogs or horses, but these are far too great rarities to be his constant resort. The common objects of his search are dead mice, rats, birds, frogs, and moles; of these a bird is the most commonly obtained. In the neighbourhood of towns, every kind of garbage that is thrown out attracts those beetles as soon as it begins to smell; and it is not unusual to see them settling in our streets, enticed by the grateful odours of such substances. The burying beetles hunt in couples, male and female; and when six or

eight are found in a large animal, they are almost sure to be males and females in equal numbers. They appear to hunt by the nose only, their movements being mostly made in the night, when the faculty of sight is of but little service.

Now to the bulfinch: the beetle soon returned with his bride. Neither seemed at first to discover the exact spot; at last the male espied it, and great comfort he expressed, wheeling in circles about eighteen inches above it, in the manner of an eagle, only some half dozen miles nearer the earth: the female settled on it at once, without this testimonial of satisfaction. The male at last settled also, and the bird underwent the scrutiny of four at least of the senses—touch, smell, sight, and taste—for the heads of both were continually diving among the feathers of the bird, and a savoury and ample meal was made before the great work of burying was begun. After the beetles had appeased the calls of hunger, the bird was abandoned for awhile, both of them examining, with great care, the earth all round, to see whether it was a decent place for the funeral. Being satisfied as to the decorum of the thing, the operation of burying was commenced by the male; the lady mounting the bird, and for a time sitting quietly upon it, then hiding herself among the feathers, and allowing herself to be buried with it. The male began by digging a furrow all round the bird, at the distance of about half an inch, turning the earth outside; his head was the only tool used in this operation; it was held sloping outwards, and seemed prodigiously powerful.

After the first furrow was completed, another was made within it, and the earth was thrown into the first furrow; then he made a third furrow, but this was under the bird, so that I could only see a bit of him now and then, and I could only judge for a long time of what was going on by the heaving of earth, which formed a little rampart round the bird. As the rampart rose, the bird sank. After three hours' incessant labour, the beetle emerged, crawled on the bird, and took a survey of his work. Here he remained about an hour, still as death—he did not stir hand or foot; he then dismounted, dived again into the grave, and kept on pulling the bird down by the feathers for half an hour: its own weight seemed to sink it but very little. The earth then began heaving and rising all round; it was for all the world like a little earthquake: the feathers of the bird were again pulled, and again the bird descended. At last, after about three hours' more labour, he came up, mounted on the bird, took a survey, and then dropped down to rest as though dead, or suddenly fallen fast asleep. When sufficiently rested, he roused himself, trod the bird firmly into its grave, pulled it by the feathers this way and that way, and, having settled it to his mind, began to shovel in the earth: this he did in a very short time, by means of his broad head. He went behind the rampart of earth, and pushed it into the grave with amazing strength and

dexterity, his head being bent downward at first, and then the nose chucked up with a kind of jerk, which sent the earth forwards. After the grave was thus filled up, and the earth trodden in, it underwent another keen scrutiny all round, the bird being completely hidden; he then made a hole in the still loose earth, and having buried the bird, and his own bride, next buried himself.

The female burying beetle lays her eggs in the carcass of the bird, in number proportioned to its size; when this operation is over, and the pair have eaten as much of the savoury viand as they please, they make their way out, and fly away in quest of further adventures. The eggs hatch in two days, and produce flat, scaly grubs, which run about with great activity. These grubs grow excessively fast, and very soon consume all that their progenitors had left. As soon as they are full grown, they leave off eating, and, burrowing deeper in the earth, change to chrysalises. The length of time they remain in this state I don't know; but when changed to beetles, they make round holes in the ground, from which they come forth.*

RESPIRATION.

On June 18, a paper was read before the Royal Society, "On the influence of the Respiratory Organs in regulating the Quantity of Blood within the Heart." By James Wardrop, Esq.

The author observes that the act of inspiration tends not only to favour the passage of the blood into the venæ cavæ, but also to detain it in the pulmonary vessels,—in consequence of the expansion of the lungs allowing of its more ready ingress into the pulmonary arteries, and impeding its exit by the veins—and thus retards its return to the heart. On the other hand, the collapse, both of the lungs and of the parietes of the chest, during expiration, assists the transmission of arterial blood from the lungs into the left cavities of the heart, and promotes its passage into the aorta. Thus he considers inspiration as an auxiliary to the venous, and expiration to the arterial, circulation; the first acting like a sucking, and the latter like a forcing pump, in aiding the power of the heart. On this principle he explains the influence exerted on the circulation and on the action of the heart by various modes of respiration, whether voluntary or involuntary, in different circumstances. Laughter, crying, weeping, sobbing and sighing, &c., he considers as efforts made with a view to effect certain alterations in the quantity of blood in the lungs and heart, when the circulation has been disturbed by mental emotions.†

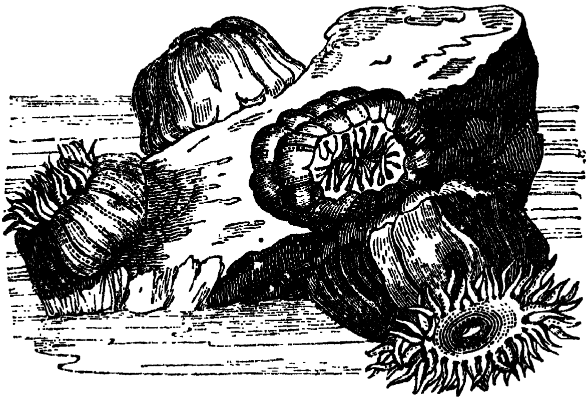
* Entomological Magazine, No. 10.
† Philosophical Magazine, No. 39.

ACTINIA MESEMBRYANTHEMUM.

By George Johnston, M. D.

Synonymes.—Priapus equinus *Lin.*, Syst. edit. 10. p. 656. Hydra disciflora, tentaculis retractilibus, extimo disci margine tuberculato, *Gærtner*, in Phil. Trans., lii. 83. t. 1. f. 5. Actinia equina *Lin.*, Syst., p. 1088.; *Dicquemare*, in Phil. Trans., lxiii. 364. t. 16. f. 1—7.; *Mull.*, Zool. Dan. Pr. p. 231. no. 2793.; *Flem.*, Br. Anim., p. 497.; *Cuv.*, Reg. Anim., iii. 292. Ac. mesembryanthemum *Soland.*, Zooph., p. 4.; *Turt.*, Br. Faun., p. 131. Ac. hemisphærica *Pen.*, Brit. Zool., iv. 104.; *Berk.*, Syn., i. 186. Ac. rufa *Stew.*, Elem., i. 393.; *Lam.*, Anim. s. Vert., iii. 67. Hydra mesembryanthemum *Stew.*, Elem. ii. 451.

There are few more common or more beautiful animals on our shores than Actinia mesembryanthemum. It lives between tide-marks, and is to be met with almost everywhere; but here it prefers the cavernous recesses, or *coves*, which the tide has hollowed out in our bold rocky coast. The floor and sides of these gloomy caves are studded with numerous specimens, hanging in a somewhat horizontal position, for they are rarely to be observed either quite erect or pendulous. Many are left long uncovered by the recess of every tide, when they lie relaxed



and in a state of partial expansion, very indicative of apathy and lazy repose: others, having chosen a little rocky basin, filled with the purest water, for their residence, are generally seen expanded; the tentacula all displayed, and held so still, that no ripple or current alarms the unsuspicious crab or snail as it creeps within the circle of these tubulous suckers, from whose embrace it will certainly not escape. Actinia mesembryanthemum never, so far as I have observed, emits from the mouth, like some other species, any thread-like tangled filaments: nor does it seem to have the power of protruding the membrane of

the stomach in the form of vesicular lobes. Gærtner says that "the colour of its body is always red in the summer, but changes into a dusky green, or brown, towards the latter end of autumn," a remark which certainly does not hold good on the northern shores of England, where the red and dusky green varieties may be found at all seasons.

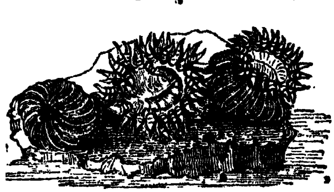
The body is an inch, or an inch and a half, in diameter, hemispherical when contracted, very smooth, and of a liver brown or olivaceous colour; the base is generally of a uniform greenish colour encircled with an azure blue line, but frequently it is streaked with red, and the blue marginal line is wanting; tentacula numerous, multiserial, of the colour of the body, entirely retractile; margin of the oral disk ornamented with a circle of azure blue tubercles, which are formed by papillary projections of the proper substance of the body, covered over on the top with a thick layer of dense blue matter; in which, as well as in the skin generally, minute fusiform calcareous spicula, of a thicker and more slender sort, may be detected in abundance, with the microscope. The animal appears to be subject to very little variety, but occasionally specimens occur streaked with lines of a fine bluish or green colour, which are sometimes interrupted or broken into spots. Very young specimens have only a single circle of tentacula, which are proportionally longer than they are in the adult.*

ACTINIA VIDUATA.

By George Johnston, M. D.

Synonymes.—Actinia viduata *Mull.*, Zool. Dan. pr. p. 231. no. 2799.; Zool. Dan. t. 63. fig. 6, 7, 8., copied into the Encyclop. Method. tab. 72. fig. 4, 5.; *Turt.*, Lin., iv. 101.

The body, when contracted, forms a very depressed cone: when relaxed or expanded, it is cylindraceous, about half an inch in diameter, and scarcely so much in height, smooth, olivaceous, striped longitudinally with white: the tentacula are shorter than the diameter of the disc, biserial or triserial, olivaceous, prettily annulated with white, with a darker ring at the base, and the oral disc is mottled or striated with pale lines.



This may be, as I long believed it was, an immature state or variety of the preceding; but I have lately discovered some peculiarity in its habits which induces me to consider it distinct. Actinia mesembryanthemum is always exposed, and very cleanly in its person, never allowing its glossy coat to be soiled by mud

* Magazine of Natural History, No. 46.

or other extraneous matter; but A. viduata buries itself in the sand, and lies very snugly concealed. Attaching itself to shelving rocks which are covered with compact sand for about an inch in depth, it burrows in the same, leaving a small aperture opposite the mouth, through which the tentacula are displayed when the tide flows. At ebb nothing of the animal can be seen, and the holes in the sand scarcely betray it, for they are exactly similar to those of most arenicolous worms.*

THE THREE RACES OF THE HUMAN SPECIES, AS CONNECTED WITH DIFFERENT LANGUAGES.

PRICHARD has compared the distribution of languages with that of the races of the human species, and has shown the contradictions which occur in regard to the origins of languages, by assuming the existence of three distinct races; since by applying the principle of physical characters to the consideration of the races, nations are united with one another, which, in respect to their languages, belong to entirely distinct classes. He instances that in the Mongolian race, the two great tribes which compose it, the Chineses and the Mongolins, are unnaturally united, since their languages proceed from entirely opposite principles. The language of the Mongolians is polysyllabical, and has declensions and conjugations; while the language of the Chinese contains only words of one syllable, which without declension and conjugation, come into different relations to one another by difference of accent and position. The religion of Fo, which is common to both nations, cannot be adduced as an argument, as it was adopted by the Mongolians at a later period. The American Indians, who, in respect to their features, seem to resemble the Mongolians, have, on the contrary, an entirely excluding peculiarity in their languages, in so far as that the American languages, however different they may be from one another, possess, nevertheless, a number of polysyllabical words, the forms of which are almost infinite. We can at once perceive that these objections of Prichard's cannot affect the principle of the division of the human race upon physical principles, but that they are merely directed against certain attempts to carry out this principle. Further although the nations of the Caucasian race are for the most part completely connected by their language, while the Fins and Hungarians, which were considered by Cuvier as belonging to this race, must, according to Prichard, be separated from it on account of the peculiarities of the roots of their languages,—peculiarities which are common to themselves alone; and although, likewise, the Tartars and Turks, who are also referred to this race, on account of the

* Magazine of Natural History, No. 46.

relation of their language to that of the Jacutes, have also a resemblance to the tribes of the Mongolian race, still this is not a good argument against the existence of races, but it is only at most a difficulty in the consideration of the Caucasian race, and an objection against a peculiar mode of classification. Still more groundless are Prichard's objections to the Negro race, whose languages are so various; and it can hardly be regarded as a serious remark, when he says that all the separate Negro tribes, viz. the woolly-haired inhabitants of the mountains of New Guinea, and the Papuas of the Eastern Ocean, have acquired their characters from the climate of these regions, for it is known that physically distinct races preserve their physical characters in the same climate. The actual existence of races is proved by the indestructible distinctions of the Negro and all other races. The difficulty lies only in the classification of the races besides the Negro one,—a difficulty which will probably never be solved, and owing to which we must limit ourselves to an uncertain determination of the boundaries, by the united assistance of the physical and moral characters, and of languages and history. The conclusion of Prichard, that originally there was only one stem of the human race, is, it is true, not contradicted by the belief that, under the present relations of climate, there exist various constant races of the human species; but such a conclusion is not rendered more probable than it formerly was, by the interesting observations of Prichard on languages and nations.*

INTRODUCTION OF FROGS INTO IRELAND.

It is not generally known that the introduction of frogs into Ireland is of comparatively recent date. In the seventeenth number of the Dublin University Magazine, there is a quotation from the writings of Donat, who was himself an Irishman, and bishop of Fesulæ, near Florence, and who, about the year 820, wrote a brief description of Ireland, in which the following passage occurs:

> "Nulla venena nocent, nec serpens serpit in herba;
> Nec conquesta canit garrula rana lacus."

"At this very hour," says our respected contemporary, "we have neither snakes nor venomous reptiles in this island; and we know, that, for the first time *frog-spawn* was brought from England in the year 1696 by one of the Fellows of Trinity College, Dublin, and placed in a ditch in the University park or pleasure-ground, from which these very prolific colonists sent out their croaking detachments through the adjacent country, whose progeny spread from field to field through the whole kingdom. No statue has yet been erected to the memory of the na-

* Professor Müller of Berlin, quoted in Jameson's Journal, No. 36.

tural philosopher who enriched our island with so very valuable an importation of melodious and beautiful creatures." We may state, however, that we have learned from good authority, that a recent importation of snakes has been made, and that they are at present multiplying rapidly within a few miles of the tomb of St. Patrick.*

APPARENT DEATH, WHICH CONTINUED FOR TWENTY DAYS.

By Dr. Schmid.

A YOUNG man died in the hospital at Paderborn, who could not be buried until three weeks after he had breathed, at least to all appearance, his last breath. It was not till the twentieth day that the characteristic phenomena of death became manifest. The circumstances of the case were these:—This young man had been a little time before cured of a tertian ague, when he re-entered the hospital, presenting some signs which caused an apprehension of phthisis, without, however, presenting any well-marked symptoms of this disease. In other respects, no disturbance in his health. On the day he died, his eyes were suddenly opened, and for some minutes we found an irregular beating of the pulse. Several small wounds resulting from cauterizations, to which we then had recourse to rouse him, suppurated the second, third, and fourth days. On the fifth, the hands of the body were turned back; from the fifth to the ninth day there exhaled from half the body an abundant sweat, free from odour. Towards the end of the ninth day, there appeared over a considerable part of the dorsal region serious bullæ, similar to those of pemphygus. The limbs still preserved their natural suppleness, and on the eighteenth day the lips still retained their red vermilion colour. For nine days the forehead continued furrowed with vertical wrinkles, and all this time the countenance preserved an expression never presented by the face of a dead body. The body was kept for nineteen days in a warm room: it exhaled not the least fetid odour, and there was observed on no part of its surface any cadaveric lividity. The emaciation was very considerable, a circumstance which, if it had existed, might have served to explain these different phenomena.†

NEW BIRDS.

ON Jan. 24, Professor Jameson exhibited to the Wernerian Society, a new bird, which appeared to belong to the genus Eurylaimus, and which he named Dalhousiæ, in honour of the Countess of Dalhousie, who has long been distinguished as an enthusiastic admirer of nature, and a successful cultivator of natural history. It was described in the following terms:—*Bill* greenish-black; on its edges, along the culmen, and at the tip,

* Dublin Journal, No. 15. † Dublin Journal, No. 14.

yellowish-white: length 3-4ths of an inch; breadth at base 3-4ths of an inch. *Nostrils* ovoid, inserted at the base of the bill, and partially covered with feathers. *Body* grass-green above: below, apple-green. Throat of a golden yellow, which extends round the neck, and terminates at the occiput with a few sky-blue feathers. Occiput and top of the head, greyish-black, with a crest of sky-blue. Ear-coverts and face golden-yellow, mixed with sky-blue. *Wings* short; 1st and 4th quills equal, 2nd and 3rd the longest: external webs of quill-feathers grass-green; internal bluish-black, with a broad band above in their centre of sky-blue; below, there is one of greyish-white, which extends across the internal web of the seven first primary quills. *Tail* Berlin-blue, very long, and strongly forked; the two middle tectrices much the longest. *Tectrices* twelve in number. Total length of body from the tip of bill to point of tail, eleven inches; tail, five inches. *Tarsus* weak,* and rather longer than middle toe; length an inch and a quarter. *Toes*, external united to middle by two joints; internal by one. The specimen of this very rare and beautiful bird, which is a native of Northern India, was brought from thence by Lady Dalhousie. It was remarked, that it is distinguished from the typical specimen by the following characters:—The first that strikes us is the position of the nostrils, which, as already noticed, are inserted at the base of the bill, and partially covered with feathers. In the typical species, they are quite naked, and inserted at a distance from the base. Secondly, the strong cuneiform tail, and shortness of the wings; and lastly the weakness of the tarsi. Although the bird presents a peculiar group of characters, it was not considered advisable to form a genus of it, until its habits and manners were made known. Its locality is also interesting, from it pointing out that this genus probably extends over all India proper.

At the same meeting, a specimen of a new Meliagris, from New Holland, was exhibited and described. The trivial name of Lindesayii was given in honour of Colonel Lindesay, a distinguished officer, and very active naturalist, formerly commander of the 39th regiment in New South Wales, but now removed to India. This bird gave rise to the erroneous opinion that *vultures* exist in the Australian continent.*

ON LUG-WORMS.

By George Johnston, M.D.

The worms which constitute the little family named Arenicolidæ, are of the number of those which connect the Annelides errantes with the A. tubicoles, their organization being of that undecided and commixed character, that some naturalists have placed them in the former, and others, of equal authority, in the

* Jameson's Journal, No. 36.

latter order. Thus Savigny arranges them among the Serpulidæ, a family of Tubicoles; but Cuvier among his Dorsibranches, which is almost synonymous with the Errantes of Audouin and M. Edwards.

The body of the Arenicolidæ is vermiform, cylindrical, and formed of comparatively few segments; but the segments themselves are annulated, or divided into a certain number of circular plaits or rings: it is acephalous and obtusely pointed in front, truncated behind, and, for the sake of description, may be divided into three portions; an anterior, which is generally inflated, and always abranchial; a middle, distinguished by carrying the branchiæ; and a posterior, which is both apodal and abranchial, but which the species figured for the present illustration proves not to be essential. At the end of the anterior extremity we find the mouth, which is provided with a short edentulous retractile proboscis, roughened with conical fleshy papillæ: there are neither eyes, nor antennæ, nor cirri. The feet are all similar in structure, and consist of a dorsal branch garnished with proper bristles, and of a ventral ridge (scarcely perceptible on the anterior segments), surmounted with a series of embedded crotchets. Upon a certain number of the middle and posterior segments we find highly developed branchiæ, fixed, like miniature arbuscules, behind the dorsal branch of the foot.

There is only one genus in this family, the Arenicola of Lamarck; the name derived from *arena*, sand, and *colo*, to dwell in, and very expressive of the habits of the species. These may be characterized as follows:—

1. *A. piscatorum.* Branchial tufts 13 pairs; the first six pairs of feet and the tail abranchial.

   Lumbricus punctis prominulis *Lin.*, Faun. Suec., 364. No. 1270.—Lumbricus marinus *Lin.*, Syst., 1077.; *Mull.*, Zool. Dan. Prod., 215. No. 2609.; *Fabr.*, Faun. Grœnl., 279.; *Penn.*, Brit. Zool., iv. 64. pl. 20. fig. med.; *Turt.*, Gmel., iv. 58.; *Stew.*, Elem., ii. 354.; *Turt.*, Brit. Faun., 128.; *Home*, Comp. Anat., iv. pl. 40. fig. 1, 2, 3.; *Roget*, Bridgew. Treat., i. 277. fig. 135.—Arenicola piscatorum *Lam.*, Anim. s. Vert., v. 336.; *Audouin* and *Edw.*, in Ann. des Sc. Nat., xxviii. 420. pl. 22. fig. 8—12.—Arenicole des pêcheurs, *Bosc*, vers, i. 190. pl. 6. fig. 3.; *Cuv.*, Reg. Anim., iii. 198.—Arenicola tinctoria et A. carbonaria *Leach*, in Supp. Encycl. Brit., i. 452. pl. 26.—Lug-worm, or Lob-worm, *Provincial.*

2. *A. branchialis.* Branchial tufts 19 or 20 pairs; the first twelve or thirteen pairs of feet and the tail abranchial.

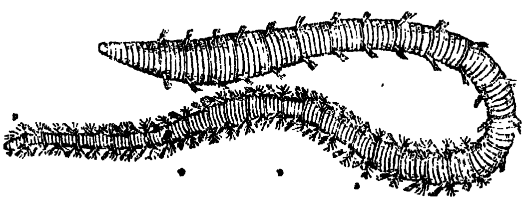
   Arenicola branchialis *Audouin* and *Edwards*, in Ann. des Sc. Nat., xxviii. 422. pl. 22. fig. 13.

3. *A. ecaudata.* Branchial tufts more than 20 pairs; the first fourteen or fifteen pairs of feet abranchial, tail none. (*Nova species.*)

Arenicola piscatorum is about 1½ in. long, contractile, cylindrical, the anterior and branchial portions thick and mutable in form; the posterior suddenly narrower, varying in colour from a yellowish to an amber brown, sometimes glossed with purple,

sometimes dusky or black, the whole surface rough with small granules: mouth reddish, puckered, with a short proboscis closely covered with papillæ; above the upper margin of the mouth, which projects a little, there is a small, smooth, somewhat triangular, spot, with a furrow in the middle: segments 19 between the mouth and the last pair of branchiæ, as long as their own diameter, each consisting of five granulous rings separated by an impressed line, their own divisions marked by an elevated band very obvious when the worm contracts; first segment conoid, each of them furnished with a pair of setigerous feet protruding near the band of separation, the first pair small, gradually enlarged on the other segments; the seventh pair with a small branchial tuft at its base, and every foot behind this has a similar but larger tuft: branchiæ red or purple, arborescent, consisting of several principal branches, which are much divided, the divisions spreading, papillary: bristles yellow, not very numerous, unequal, slightly curved towards the sharp point, smooth: underneath this setigerous foot there is a transverse fold, armed with a series of crotchets shaped like the italic letter *ſ*; they are few under the first pairs, but become more numerous under the branchial pairs, forming a ridge which meets its opposite on the mesial line: the tail is equal to the rest of the body in length, the segments indistinct, but often constricted at intervals, and sometimes so regularly, that it might almost be described as moniliform.

Arenicola branchialis has not been noticed as yet on the British coast: it is smaller than the preceding, and, in this respect, as well as in the number of the branchiæ, approximates the A. ecaudata, from which I might not have considered it distinct, had any specimen of the latter exhibited any trace of posterior abranchial segments; and the fishermen assure me that the want of a tail is an invariable character.



Arenicola ecaudata is from 6 in. to 8 in. long, very contractile, minutely granular, of a yellowish brown, tinted in many places with green and yellow, or sometimes very black, glossed with green: the primary rings seem to be composed of only four intermediate ones: the first fourteen or fifteen pairs of setigerous feet are destitute of branchiæ, but to every foot behind these there is appended a dark red arborescent branchial tuft; in one

specimen there were twenty-two pairs, in another twenty-five; the first few pairs are smaller than those about the middle, whence they again decrease towards the tail. In other respects, the structure is similar to that of Arenicola piscatorum.

The lug-worms burrow in the sand, prefering a station near low-water mark. The hole is about 2 ft. in depth, and the presence of the worm is detected by the spiral rolls of sandy excrement coiled above its aperture; for these worms twist their "ropes of sand" with an ease which spirits might envy, and renew them after every reflux of every tide. They live in the hole with the head downwards, and ascend and descend with amazing rapidity. The worm "bores its way through the sand by means of the peculiar construction of the rings of its head, which, when elongated, has the shape of a regular cone. As each ring is so much smaller than the one behind it as to admit of being received within it, the whole head, when completely retracted, presents a flat surface. When this disk is applied to the sand, the animal, by gradually projecting the cone, and successively dilating the rings of which it is composed, opens for itself a passage through the sand, and then secures the sides of the passage from falling in by applying to them a glutinous cement, which exudes from its skin, and which unites the particles of sand into a kind of wall, or coating. This covering does not adhere to the body, but forms a detached coherent tube, within which the animal moves with perfect freedom, and which it leaves behind it as it progressively advances; so that the passage is kept pervious throughout its whole length by means of this lining, which may be compared to the brick-work of the shaft of a mine or tunnel."—*Osler*, quoted in Roget's *Bridgewater Treatise*, i. 278.

The intestine of the lug-worm is always full of sand, from which it doubtless extracts the intermixed nutritive matter; and the colour of the body appears to depend on the nature of the ground the worm burrows in, and on which it feeds, being yellowish brown when in pure sand, and very dark, or even coal-black, when the soil is miry and equally dark-coloured. In Berwick Bay, specimens of both species, of all shades, occur. Vast numbers are daily dug up on all parts of the coast by the fishermen, who esteem them one of their best baits. They discharge, on handling, a liquor that imparts a yellow stain to the fingers, which it is difficult to remove.*

ANATOMY OF THE SLOTH.

In the Linnæan Transactions, vol. xvii., pt. 1, 1834, Dr. Buckland, in that spirit of benevolence with which the writings of naturalists are almost universally inspired, reproves the harsh

* Magazine of Natural History, No. 54.

sentence which has been passed on the sloth by Cuvier, and strives to show that this vulgar type of indolence is undeserving the imputation of feebleness or imperfection, and still more of the charge of monstrosity; that it affords a striking example of perfect mechanism and contrivance, when viewed in reference to the office it is destined to fulfil, "the animal being fitted to its state."

Cuvier has stated that we find in sloths such few relations to ordinary animals that the general laws of existing organizations supply so little to them, and the different parts of their body seem so much at variance with the laws of co-existence which we find established throughout the rest of the animal kingdom, that we might really believe them to be the remains of another order of things, the living relics of that preceding state of nature whose ruins we are obliged to search for in the interior of the earth, and that they have by some miracle escaped the catastrophe which destroyed the other species which were their contemporaries. The skeleton of the *Bradypus tridactylus*, or *Ai*, says Cuvier, affords proportions extremely anomalous, and apparently defective: the arms and fore-arms taken together are almost double the length of the thigh and leg, so that when the animal goes on all fours he is obliged to drag himself upon his elbows, and if he attempted to stand erect upon his hind feet, the entire fore foot would still rest upon the ground; but the *Ai* never can stand upright, because his hind feet are so ill articulated for walking that they are unable to support the body in such a position; the pelvis is also so broad, and its cotaloid cavities so set back that the thighs are kept at a distance, strutting outwards, and the knees can never approach one another. The length of the fore legs embarrasses the animal in its attempts to walk, and its forward movements on the ground are made by fixing its claws on an object and then dragging its body up to it. This is the unfavourable side of the subject. Dr. Buckland views it in a benevolent light. The extraordinary length of the arm, and fore arm, so inconvenient for moving on the earth, are of essential and obvious utility to a creature whose body is of too great weight to allow it to crawl to the extremity of the branches to collect the extreme buds and youngest leaves, which form its food; these long arms, in fact, perform the office of the instrument called "lazy tongs," whereby the creature brings food to the mouth from a distant point without any movement of the trunk. The structure of the arm fixed to the shoulder by an universal joint admitting of rotation, and having at the elbow two kinds of articulations which allow pronation and supination, gives to the hand a power of moving in every possible direction. The breadth of the pelvis and outward position of the thigh bones, which are also broad and flat, the distance of the knees from one another, and curvature of the bones of the leg, admirably adapt these extremities of the animal to the purpose of clasping, and, as it were, riding upon the trunks and branches of trees. A peculiar condition of life was to be provided for, viz. that of a quadruped which was to feed, to sleep, and in short, to dwell entirely upon trees, for the succulent nature of its food renders it unnecessary to descend to drink; and if we look at the anomalous extremities of this animal with a view to their use as instruments of continual suspension upon trunks and branches, the hind legs performing the double office of adhesion and progression, and the fore legs the quadruple function of adhesion, progression, prehension, and defence, we shall find

each article of deviation from ordinary structure adapted to some useful function in its peculiar economy, we shall find a new system of machinery contrived and set together as it were on a new plan, from old materials, (as machines of different functions may be compounded from similar wheels, every motion having relation to some well defined and useful end,) and the result of these deviations presenting an animal structure not less perfect, in reference to its state, than those slender and graceful forms of light and active quadrupeds with which we usually, and perhaps more justly, associate our ideas of perfect symmetry and beauty.

The stiffness of the toes and fingers of this animal, which fit it for the habit of constantly living and feeding upon trees: and the difficulty of motion in other joints become advantageous and a source of strength to an animal living as it does, while to one moving on the ground, they would be a source of great inconvenience. The claws of the sloth are of unusual length, and so powerful that they are capable of strangling a dog, holding him at arm's length. On trees the sloth is surprisingly tenacious of its hold. Mr. Burchell has seen the limbs, even just after death, continue fast clinging round the object to which they were adhering before the animal expired. All mammalia, from the giraffe and camel down to the cetacea, have invariably seven cervical vertebræ, while the sloth was considered to have nine. Mr. T. Bell has, however, shown that the two lowest are really dorsal, but their position so far in advance of the clavicle and scapula, enables them to co-operate with the seven true cervical vertebræ, in increasing the rotatory motion and flexibility of the neck. Hence, the animal has the power of looking backward over its own shoulder. Mr. Burchell has observed, that this animal can turn its head quite round, and stare a person in the face who is directly in its rear, while at the same time the body and limbs are unmoved. He also noticed, that his captive sloths assumed, during sleep, a position of perfect ease and safety on the fork of a tree; their arms embracing the trunk, their backs resting in the angle of a branch, and their heads reclining on their own bosom, the animal being thus rolled up nearly in the form of a ball, with the vertebral column bent circular. The sloth has no incisor teeth, because the leaves are brought to the mouth, being collected from the branches by the powerful claws.

Besides the four canine teeth, there are on each side four molars in the upper and three in the lower jaw. The construction of these teeth is the most simple that exists; they are composed of a cylinder of bone encased with enamel and hollow at the two extremities, the upper cavity being produced by the act of mastication, which wears away the softer bony texture of the interior more readily than the exterior enamel, and the lower cavity being filled with gelatinous pulp, which maintains the continual growth of the tooth; these simple teeth, being employed exclusively in the mastication of buds and leaves, are fully adequate to the wants of an animal which has no need of more complicated teeth. Mr. Waterton states that he, "in crossing the Essequibo one day, saw a large two-toed sloth on the ground upon the bank; though the trees were not twenty yards from him, he could not make his way through the sand time enough to make his escape before we landed, he threw himself on his back and defended himself with his fore legs. I took a long stick and held it for him to hook on, and then conveyed him to a high and stately mora, he ascended with wonderful rapidity, and in about a minute he was almost at the top of the tree; he now went off in a side direction

and caught hold of the branch of a neighbouring tree, he then proceeded towards the heart of the forest."

When resident at Para, near the mouth of the Amazons, Mr. Burchell kept two full-grown sloths and a young one of a three-toed species, in a garden inclosed with strong stockades; they were kept tied up to the pillars of a veranda to prevent their escape; against these pillars they always placed themselves in an erect position, embracing the pillar with all four legs; when not tied to the veranda they got up into trees in the garden; they slept both day and night, always fixing their arms round something or other; their food, consisting of branches, was brought to them in the veranda: they appeared extremely stupid, and would never come to the food; they would eat no leaves but those of the *cecropia*.

None of these animals were ever seen to drink. The full-grown ones were never heard to utter any sound, but the young one occasionally (though rarely) gave a short cry or whistling squeak of a single note. They showed no indication of fear, and seemed to give attention only with their eyes. They took no notice of the boy that carried them often across the garden to their place in the veranda with their long arms sprawling—the only objects of their regard were trees—they fight on their backs and grapple their enemy to strangulation. The use of the long wool that covers the body and even the face, seems to guard them from the annoyance of insects.*

PRINCIPLES OF CLASSIFICATION IN THE ANIMAL KINGDOM.

By Professor Agassiz.

ALTHOUGH the principal groups of animals are impressed with such characters as to be easily recognised and to admit of little doubt, yet their order and succession have been determined by no general principle. This appears from the discrepancy in the position assigned to them by the most eminent systematists, each of whom has assumed, arbitrarily, some organ or system of organs for the basis of his arrangement. Professor Agassiz,(at the last meeting of the British Association), after adverting to some German naturalists who alone have sought after a general principle which should be satisfactory to "philosophic naturalists," passed in review the classes of the animal kingdom, each of which, he stated, exhibited in an eminent degree the developement of some one of the animal functions. While vertebrate animals (with man their type) arrive at the greatest perfection in the organs of the senses, the invertebrate offer in the class of worms the representative of the system of nutrition, in *crustacea* of circulation, in insects of respiration, and in *mollusca* of generation. The Professor next proceeded to demonstrate in what manner each subclass of vertebrate animals derives its peculiar character from some one element of the animal economy.

This predominant element is the bony skeleton in fishes, the muscular structure in reptiles, the sensibility of the nervous

* Transactions of the Linnæan Society, vol. xvii., pt. 1, quoted in Thomson's Records, No. 5.

system in birds, and the perfection of the senses in *mammalia*, which therefore reproduced the distinguishing character and constitute the type of vertebrate animals. He next showed that each of the other subclasses of the higher group is represented among the *mammalia* along with its own peculiar type. He explained his reason for the fourfold division which he had adopted in the subclass, pointing out the close affinity which connects the *ruminantia*, the *pachydermata*, the *rodentia*, the *edentata*, and the herbivorous *marsupialia*, (in none of which is the true canine tooth developed,) which he considers as forming a single group; in another he unites those characterized by the presence of the canine tooth in its proper function, (as an instrument of nutrition, not merely of defence), viz. the *carnivora* and those *marsupialia* which partake of their character, and the *quadrumana*. The *cetacea* form a group in themselves; and man another. The manner in which these represent the subclasses of *vertebrata* was exhibited by the comparison of

Cetacea,	with Fishes,
Ruminantia, &c.	Reptiles,
Carnivora, &c.	Birds;

while man is the perfection and type of the mammiferous conformation.

Professor Agassiz then applied this principle to illustrate the order and succession of the groups in *mammalia*, by a reference to the order in which the fossilized remains of the *vertebrata* occur in the stratified deposits: 1. fishes, 2. reptiles, 3. birds, 4. mammalia. From the same consideration results the following arrangement of the representative groups among these last: 1. *cetacea*, 2. *ruminantia*, &c., 3. *carnivora*, 4. man, who thus in a twofold aspect becomes the culminant point of the animal creation.*

NEW CETACEOUS ANIMAL.

D'ORBIGNY, in his Travels in South America, discovered a new genus of cetaceous animals, in the rivers of Bolivia, especially those of Moxos, which run into Mamore, and thence into the Amazon at Santa Cruz, at least 700 leagues from the sea. It differs essentially from the dolphin or *sousou* of the Ganges, although it possesses the characters of a dolphin. He terms it *Inia Boliviensis*. Inia is the Indian name of the fish.

The specimen examined was a female. It was 2 met. 4 cent. in length (8·14 feet.)

Dorsal circumference 1 met. 4 cent. (4·85 feet.)

Above, the body was pale blue, passing into red below. The tail and fins were blue; but these vary considerably, for some specimens are reddish. Those which inhabit the great rivers are pale, while those which enter the great lakes which commu-

* Philosophical Magazine, No. 42.

nicate with the rivers during the rains, are almost black, and do not lose their colour for a long time after their re-entry into the rivers.

The body is thick and short, when compared with common dolphins. The snout is very slender, almost cylindrical, and obtuse at the extremity. The mouth terminates a little below the eye, and forms a linear opening, only arched at the posterior part. The nasal canal is so oblique that its orifice is placed almost above the swimming paws. Behind the eye, is the meatus auditorius externus. The anterior fins are large and obtuse at their extremity. The dorsal one is placed at about a third from the extremity of the tail. The posterior part of the body is compressed. The tail is large, and divided in the middle. The cranium is depressed. The snout is long, and supplied with teeth throughout its whole length, and has from 130 to 134 teeth. The vulva of the specimen examined was much swelled. The mammæ, situated on the sides of the vulva, were filled with milk, which was easily pressed out. It appears that the males attain a greater length than the females, some of the former reaching a length of 4 metres (13·12 feet.) This species was found in all the rivers in the province of Moxos. It reaches the bottom of the Cordilleras and never appears to visit the ocean, because it is so slow in swimming, that it could not possibly pass the 19 cascades of the river Madeiras, which exist in 9° and 10° S. L. The Brazilian merchants who have travelled from Mato-grossa to Para, state that these dolphins are found only above the falls. that is to say, in the numerous rivers comprised between 10° and 17° S. L.

When not alarmed, these animals come quietly and much more frequently, than the marine species to breathe at the surface of the water, but when frightened they increase their speed, which is never so rapid as that of the sea species. They generally swim in threes or in pairs. Their sense of hearing seems very acute. They prey upon the smaller fish, and frequently come to the surface to devour their victims, which the sea dolphins never do. The Brazilians call them *Botc*, the Spaniards *Bufeo*, the Guayaros *Inia*, the Chapacuras *Sisi*, the Baures *Thui*, the Moxos Indians *Aico*, the Itonamas *Puchca*, the Cayuvava *Potohi*.*

THE ASIATIC ORANG-OUTANG.

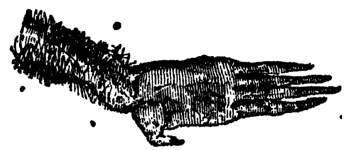
ANNEXED is a specimen of the Asiatic orang-outang, (*Simia Satyrus*, Linn.) which was received at the Surrey Zoological Gardens during the past year. It was a female, about four years old, and was brought in a trading vessel, with three others, from the island of Borneo to Calcutta. Here they were purchased by

* Nouv. Ann. du Museum, quoted in Thomson's Records, No. 7.

Mr. Hunter, and shipped on board the Orontes; the present, however, alone survived, the three others having died from the effects of change of climate before reaching England. On board ship, these orangs were not confined, but permitted to mount aloft, and gambol with the sailors during the voyage; retiring to the caboose, or cabin, for warmth during the night.

The engraving shows the conformation of the animal with characteristic accuracy. It occupied a roomy cage in a repository. The building was warmed by a hot-water apparatus, a provision highly requisite for the native of an island under the equator. Here, next another of its own tribe, the blue-faced Satyr, or Mandrill, our orang sat nestling in a blanket, to screen her from any chilling wind, and seated in a chair, as is the cus-

tom of her congeners in confinement—an indulgence allowed them as if to compensate for their loss of liberty. The orang could not maintain the erect position for any length of time, and, when walking, placed her bent fists on the ground, swinging her body between the arms. The thumbs were generally bent together with the fingers: when drinking from a wine-glass, she grasped it awkwardly by the stem, lengthening out her lips to the liquid, and not pouring it between them; and then returning the vessel, without throwing it down, to the person who gave it. The orang was remarkably fond of warmth, and covered herself with the blanket even during the late hot days; upon any attempt being made to take the covering from her, she became violently excited, shrieked and threw herself on the ground, and became altogether as obstreperous as an angry child.



The present specimen was of the usual reddish brown, or dark chestnut colour: her nails being black. It does not appear to be an undeviating characteristic of the animal to have the nail on the great toe; as, in this specimen, it was entirely deficient. Camper, the Dutch naturalist, concluded this absence of the great toe-nails to be a specific distinction of the Borneo orang-outang; an erroneous opinion, which has been corrected by Cuvier, and the facts of an orang brought from Borneo to Calcutta in 1827, and another from Sumatra, having nails upon their great toes; the absence of which, in the present specimen, may, therefore, be regarded as accidental. The principal measurements were as follow:—

	feet.	inches.
Height from vertex to heel - - - - - -	2	2
Length from the extremity of shoulder-blade to the end of the middle finger - - - - -	1	9
From the wrist to the end of the middle finger -	0	6½
Length of the palm of the hand - - -	0	3½
sole of the foot - - - - -	0	5
Width over breast - - - - - - -	0	9
Weight, avoirdupois, - - - - - -	15lbs.	
Circumference round the chin over the vertex - -	1	6

The second cut shows the peculiar conformation of the hand. The orang died on July 21, having survived her arrival in England about two months.*

* Abridged from the Mirror, No. 725; the facts and measurement supplied by Mr. J. Warwick, of the Surrey Zoological Gardens.

MODE OF PRESERVING ECHINODERMATA.

In the year 1828, the Rev. Charles Mayne, being at the sea-side, collected many *Echini* for examination; and the house not being large enough to afford him a separate room, he used chloride of lime to prevent inconvenience to the family from the smell. He soon perceived that the *Echini* steeped in the solution did not lose their spines; he accordingly tried to preserve them with all their spines on, and succeeded completely. He has since tried this process with many *Echini* and small star-fish. The preparation should not be so strong as to act sensibly on the surface of the crust, as in that case he found that the spines would fall off.*

VITALITY OF ŒSTRUS OVIS.

By Mr. A. H. Davies.

On the 26th of September last, being at Ventnor, in the Isle of Wight, I observed on the walls of a house a fine specimen of *Œstrus Ovis*. Having captured the insect, I pierced it, and being about to leave for a day's excursion, I set the wings out, knowing that Dipterous insects generally die speedily. I believe I opened the box several times before my return to town, but the insect appeared perfectly still; at least I did not observe any thing to attract my attention. But, on the 8th of October, I was about to unpin the specimen and consign it to my cabinet, when to my surprise, I found it still alive, and comparatively strong and active. Entertaining, as I do, the opinion that insects are not susceptible of much sensation, I am still averse from allowing them to remain pierced when they may much more readily be deprived of life; but in this case, I thought the fact so remarkable, that a departure from my ordinary plan, which had been unavoidably carried so far, might be permitted, for the sake of ascertaining to what extent vitality, under such circumstances, might exist. I examined the box day by day, and it was not till the evening of the 13th that I found the legs motionless; even then they were sufficiently pliable to be moved so as to set the insect out. I am not aware whether there is any instance on record of life enduring in an insect, especially of this order, for so long a period. Regarding its peculiar economy and habits, it appears to me to be an interesting fact, and affords, I think, a pretty conclusive argument against those who contend for "beetles and flies suffering as much pain as the human species, or the lower warm-blooded animals,"—a doctrine so frequently to be met with in all and sundry the books written for the young on Natural History. It would be a curiosity indeed in physiological science could we hear of a man, pinned by a

* Philosophical Magazine, No. 42.

lancer's spear to the earth, resisting hunger, cold, and pain, for sixteen days; or of a turnspit dog, who should be spitted in his turn, whining out his breath for a fortnight, without even the smell of the cookery to which he had been accustomed.

I trust it will not be thought that I am contending for the practice of every insect to die by the pin. We may be inflicting a minor degree of suffering—though I think this extremely doubtful, and conceive that it would be almost as easy to persuade me that because the vegetable when cut, often pours out its juices and dies, that it also is conscious of suffering.*

ON THE METAMORPHOSIS AND NATURAL HISTORY OF THE PINNOTHERES, OR PEA-CRABS.

By W. Thompson, Esq., F.L.S.

THE species of this curious and highly interesting genus of crabs, of which the type is *Cancer pisum*, Linn, the *Pinnotheres pisum* of Latreille, &c., are exclusively parasitic, but unlike the more familiarly known hermit-crabs, which take up their residence in empty univalve shells, these find their way into the tenements of living bivalves, which the females never afterwards quit: there they remain, feed, grow, receive the visits of the males. and breed. How wonderfully they are adapted to this mode of life is obvious on the slightest inspection: their small size, rounded form, without angles or projecting spines, the softness and yielding nature of their shell, the delicacy of all their members, their extreme inactivity, are all circumstances which, on the other hand, render them more or less unfit for a separate existence; and yet some naturalists, and amongst them the intelligent and accomplished Cuvier, shut their eyes, as it were, to all these peculiarities, and pretend to doubt the leading points of their history, and imagine that it is only by accident we find these and other Crustacea within the bivalve shells! It is not because Pliny, in his voluminous compilation, appears to be at variance with himself, in his account of this animal, nor that because both ancients and moderns have embellished the subject with various imaginary conceits, that we are to discredit a circumstance so often noticed by competent observers, and that in various different species, and in both the Old and New World, and which indeed it is so easy to be convinced of by due investigation. No doubt, other crustaceous animals are occasionally found within bivalve shells, but this appears to be rare, and they are obviously of species which have a separate existence; not so the *Pinnotheres*, the females of which are *never found* in any other situation, but within living shell-fish, and the males but rarely, and this because they appear to go from shell to shell

* Entomological Magazine, No. 11.

in search of unimpregnated females, at the season of their amours. To be convinced, let any person take a sweep with a dredge on any bank of old muscles, modioli, or pinnæ, where the *Pinnotheres* have been before observed, and almost every shell will be found to contain one full-grown female, some two, and others three, independent of young ones and males, which occasionally occur in common with the females, while not a single stray individual will be seen. As the fishermen at Cove often have recourse to those shell-fish for bait, I have had a pint, and upwards, of the pea-crab brought to me out of the muscles obtained in a few hauls of the dredge, and although so very abundant, I have myself dredged in every direction within the harbour, with a very fine net, and at all seasons, and never procured *a single specimen* of the pea-crab, either male or female, in this way, although crabs equally small (*Porcellanæ*) have been abundantly captured.

Aristotle, of all the ancients, is the only naturalist who has given us any correct notions of these animals; but as he probably did not investigate for himself, he seems to be in doubt, whether the *Pinnophylax*, or guardian of the *Pinna*, was a small shrimp, or a crab. Lib. V. cap. xv. A few lines further on, he says, "There breed in some shells white and very small crabs; the greatest numbers are found in that species of muscle which have the shell protuberant (*Modioli*, no doubt); next in that of the *Pinnæ*, whose crab is named *Pinnotheres*. They are also found in cockles and oysters. These little crabs never grow in any sensible degree, and the *fishermen* imagine that they are formed at the same time with the animal they inhabit." He also gives currency to the idea, that their lives are so dependent upon each other, that if the shell-fish loses its little crab, they shortly afterwards perish themselves. It would be idle to combat such palpable absurdities: I shall, therefore, proceed to state what appears to be matter of fact.

The pea-crabs differ so much in the appearance of the two sexes, that it is not to be wondered at if they have been considered as forming distinct species by some of the most acute naturalists, a difference that results from that wonderful adaptation of the means to the end proposed throughout the whole of the creation. The females being of a domestic and indolent nature, adapted to live constantly enfolded within the soft mantle of the inhabitant of the shell, are soft and globular, with very short members; the males, on the contrary, being erratic, and going from shell to shell, require a form and structure more calculated to make their way amidst banks of shells, and within the opening valves of such as favour the residence of their mates; hence they are of a flatter form and firmer texture, of a smaller size, with long compressed members, and those adapted to swimming as well as running, being densely and deeply fringed; their extreme activity, and the facility with

which they swim, contrasting singularly with the remarkable indolence and inactivity of the other sex. This peculiar structure in the males may serve to explain that passage of Aristotle, from which Cuvier supposed that the Grecian philosopher intended a species of *Portunus*,—"Cancelli autem qui perquam exigui in pisciculis reperiuntur, pedes novissimos latiusculos habent, ut ad nondum utiles sint, quasi pro pinnulis aut remis pedes haberentur."—*De Part. Anim.* Lib. IV. cap. viii., as quoted by Cuvier, in his Diss. Crit. sur les Ecrivisses.

As the females are found with an amazing group of ova under their abdominal plate, in spring, summer, and autumn, it is probable that they have several successive broods; this circumstance renders it no difficult matter to select a number of females with mature ova at any convenient time, and to preserve them alive in sea-water for a few days, or until the ova should hatch.

Metamorphosis in Pinnotheres.

From several females selected and kept alive after the above manner, I had the satisfaction to see the ova hatch in great numbers under the form of a new kind of *Zoe*, differing from all those previously discovered, with the front and lateral spines deflected, so as to resemble a tripod. In this stage the minute animals are like all the *Zoea*, purely natatory, disperse themselves abroad, probably undergo a further change, and may be supposed to gain an easy access within the bivalve shells, before they lose the power of swimming. For a considerable time the young females are scarcely to be distinguished from the males, and in this stage both differ so much from the adult, as to render it probable that they have often been taken for individuals of a different species, as would appear to have been the case with Dr. Leach, whose figures of *Pinnotheres Latreillii*, in Mal. Pod. Brit. T. XIV. f. 6, 7, 8., refer to the young of his *P. pisum*; this, I find, is also the opinion of Montagu.

In what the food of the *Pinnotheres* consists remains to be determined, but must necessarily be, either the minute marine animals which flow in with the current of sea-water to the bronchia and mouth of the shell-fish, or the mucous secretions and ejections of the animal itself. The various notions entertained upon this subject, and upon the connexion subsisting between these two animals, may serve as an amusing conclusion to this outline of the natural history of the *Pinnotheres*, and cannot fail to excite our surprise, that such fables should ever have been written, quoted, and given credit to, by men of the character of Cicero, Pliny, Oppian, Hasselquist, &c.

"The *Pinna*," says Pliny, "is never found without its companion, which is called *Pinnotheres*, or by others, *Pinnophylax*; this is a little shrimp, in some places a small crab, which bears it company in order to partake of its food. The *Pinna* gaping

wide, and showing her naked body to tempt the little fishes, they soon make their approaches, and when they find they have full license, grow so bold as to enter in and fill it; this being seen by the guardian shrimp, by a slight nip he gives the signal to the *Pinna*, who thereupon shuts her shell and suffocates whatever it incloses, giving a share of the booty to her companion." —Pliny, Hist. Nat. Lib. IX. cap. xlii. This history is nearly copied after Cicero de Nat. Deorum, Lib. II. cap. xlviii. Oppian has a conceit still more absurd, giving to the *Pinnotheres* a remarkable degree of ingenuity and dexterity, in supposing that it throws a small stone between the valves of bivalve shells, on finding them open, which preventing them from closing, enables it to devour the inhabitant! Hasselquist goes astray in another direction, and supposes the crab to go out and cater for the *Pinna*, and when it returns, to cry out for the shell to be opened!!

On a due consideration of the facts stated in the former part of this memoir, and reasoning from analogy, we may fairly conclude that the crab is altogether useless and quite unnecessary to the well-being of the shell fish, and indeed attended with more or less inconvenience and annoyance, but that the shell-fish is absolutely requisite to the very existence of the crab, as much so, as all other animals to their respective parasites.

The species of this genus would merit a separate memoir, bearing in mind the discrepancies presented by their young and by the two sexes, which even misled the best Crustaceologist of the age, who mistook both the one and the other for so many different species, describing the young as *Pinnotheres Latreillei* and the male as *P. varians*,—Mal. Pod. Brit. T. XIV. f. 9, 10, 11.

On this part of the Irish coast but two species have been hitherto observed, viz. *P. pisum* and *P. pinnæ*, the latter being found in *Pinnæ* and *Modioli*. In the Mediterranean and Red Sea, some others are met with in the various species of *Pinnæ*, and as some of these are 2½ feet in length, we find their parasitic *Pinnotheres* to harmonize in relative size, being in these huge bivalves nearly as large as a pigeon's egg. In America, one species inhabits the *Ostrea virginica*. In the West Indies one has been discovered by the late L. Guilding, in a cell, near to the muscular attachment of the annual of *Turbo pica!* Many more will, no doubt, be added to the list of species already known, now that the attention of Naturalists has been directed to these singular animals.

From the statements of Aristotle and Pliny before alluded to, and those of a later date, by Forskal, Desc. Anim. p. 94, under the head of *Cancer custos*, of which he gives as the habitat "Lohajæ intra Pinnas nigras; in saccato raro," it is probable that some *Macrourous decapoda*, of an unknown genus, participates in the singular manners and habitudes of the pea-crabs.

It does not appear that the *Pinnotheres* are used as food any

where except in the United States of America, where the species described by Mr. Say, under the specific name of *Pinnotheres ostreum*, and found in the common oysters of that country, is said to be "excellent food, and those who eat oysters seldom reject it. When the fresh oyster is opened in considerable numbers, the crabs are often collected and served apart for the palates of the luxurious."—Journ. Acad. Nat. S. Phil. Vol. I. p. 68. From this it may be presumed, that the bad consequences often arising from eating muscles, &c., and attributed to the presence of these animals, must be owing to other causes.*

SALMON OF THE COLUMBIA RIVER.

DR. GAIRDNER, in a letter, dated Fort Vancouver, November 1834, says:—"I have ascertained already the existence of *six* distinct species of true salmon in this river; five of these I have seen and preserved; the periods of spawning of each are different. From what information I have collected regarding their habits, this is the country to study this singular fish. It is found at the very sources of the Columbia, notwithstanding the apparently insuperable rapids and cataracts which must be passed. Almost every where the natives assert that the fish which ascend the stream never return to the sea, nor were the young salmon ever seen to descend to the ocean. This last is certainly incorrect, and must arise from the fry being still so small as to elude the observations of the natives. The former is not unlikely, from the circumstance of the salmon, in the months of November and December, being found at the heads of all the streams dying by thousands, and completely choking up the current with their bodies. They have often been seen with their noses fairly worn down to the bone, and in the last stage of emaciation; yet still, by some unaccountable impulse, striving to ascend the stream to the very last gasp. It is singular that the salmon pass by some of the tributary streams in their passage upwards, and prefer some of these to others. Few or none, for instance, are ever got in the Kowalitit and Kanagun, or Deasis rivers. They seem to delight in those streams where their progress is impeded by rapids and cascades; and it is remarked that, in Fraser's River, no sooner have they emerged from the rapid waters of the main stream, into the still waters of Stuart's Lake, and the other lakes, than they become flabby and of inferior flavour. The muscular power of this fish is truly astonishing, even in a class of the animal kingdom remarkable for the vigour of their movements; for they are seen to ascend channels at the Kettle Falls, into which a stone as big as a man's head, when dropped, is shot downwards with the swiftness of an arrow, and where it is impossible by any force to push a pole even to an inconsiderable depth.†

* Entomological Magazine, No. 11. † Jameson's Journal, No. 37.

PRIVATE LIFE OF THE COCCUS OF THE VINE.

*By Rusticus.**

OUR vines are often annoyed, and sometimes rendered barren, by an insect which is called the vine-gall, or vine-coccus. The harm it does the vines is by pricking holes in the rind, and thereby letting out the sap, or, as the gardeners scientifically term it, making the vines bleed. Our climate is not hot enough for this insect to breed very fast out of doors; but in hothouses it thrives and swarms, often doing great mischief. Sometimes there are such hosts of them, that the young shoots are covered with a white cotton, which is in reality a resinous gum, produced by the cocci. The coccus pierces the bark by means of a sharp and long sucker, which goes to the very centre of the shoot, causing the sap instantly to flow in abundance. This piercing apparatus, although, like other insects' mouths, in the head, is bent so far under the breast, that it appears to proceed from that part, and I find has been often so described. The cocci in the young, or larva state, are all alike; they look just exactly like little tiny tortoises fixed to the rind, and sometimes leaves, of the vine. Like other animals, the cocci are males and females; the males are desperate rovers. When they are tired of vegetating, they push a hole through the back of their tortoise-like shell, and fly away; the females undergo no change in form on coming of age, nor do they ever break loose from their moorings.

The male and female coccus are very different, not only in size, but make: the male is a small, active, two-winged fly; the female is a large, lazy, and almost lifeless lump, ten times the size of the male, and so closely attached to the rind of the young shoots on which she feeds, that you cannot get her away without killing her. When the female has attained this immense size, and her whole body is full of eggs, she begins laying them, her body being glued down all round at the edges to the rind of the twig; but between her body and the rind, except just round the edges, is a quantity of cottony gum, spread over the whole space which she covers. The laying of eggs is on a different system to that of any other insect: the first egg is laid in the cottony substance without causing any disturbance to the margin of her body glued to the rind; it does not stick like most other insects' eggs, but lies quite loose in the cotton; then another is laid, which pushes the first a little forwards; and then another and another, none of them being visible from without; so that all the eggs that the female coccus lays, she sits on, for all the world, like a broody old hen.

The female coccus, like a good many other insects, when come of age, is a complete bag eggs. Now you will observe, that as she lays them, and then pushes them under her body,

* Entomological Magazine, No. 10.

they must raise up the under skin of her body into a manifest concavity; so that the body itself daily gets thinner and thinner, while the pile of eggs which it covers gets thicker and thicker. At last the eggs are exhausted; the under skin of the body meets the upper skin, and grows hard and fast against it; then the old lady dies, and her body, like the roof of a house, protects the inhabitants below from the inclemency of the weather. In a few days from the death of the mother, the eggs hatch, and become lively little runners, of a bright red colour. These first devour the cottony stuff among which they were born; then they manage to lift up the edge of their covering, and away they run, helter-skelter. This active life lasts but a short time: they soon get hungry, pierce the rind of the twigs, anchor themselves by the beak, settle down to serious eating, and become fixtures for life.

TEMPERATURE OF FISHES.

On March 26, a paper was read before the Royal Society, on the Temperature of some Fishes of the Genus Thynnus. By John Davy, M.D., F.R.S.

The author had occasion to observe, many years ago, that the Bonito (*Thynnus pelamys*, Cuv.) had a temperature of 99° of Fahr. when the surrounding medium was 80°·5, and that it, therefore constituted an exception to the generally received rule that fishes are universally cold blooded. Having found that the gills of the common Thunny of the Mediterranean (*Thynnus vulgaris*, Cuv.) were supplied with nerves of unusual magnitude, that the heart of this latter fish was very powerful, and that its muscles were of a dark red colour, he was led to conjecture that it might, like the Bonito, be also warm-blooded; and this opinion is corroborated by the testimony of several intelligent fishermen. The author endeavours to extend this analogy to other species of the same family, which, according to the reports of the fishermen of whom he made inquiries, have a high temperature, and in whose internal structure he noticed similar peculiarities as in the Thunny; namely, very large branchial nerves, furnished with ganglia of considerable size. In this respect he considers that in these fishes the branchial system of organs makes an approximation to the respiratory apparatus of the Mammalia, and that it probably contributes to the elevation of temperature, resulting from the more energetic respiration which he supposes to be exercised by these organs. He, however, thinks it not improbable that these fish may possess means of generating heat peculiar to themselves, and of which at present we have no adequate idea. He conceives that the situation of the kindneys, of which a considerable portion is even higher than the stomach, and posterior to the gills, and which are of large size, and well

supplied with nerves and blood-vessels, may possibly act a part in the production of an elevated temperature; but, on the whole, he is disposed to ascribe the greatest share of this effect to the superior magnitude of the branchial nerves.*

THE TURNIP-FLY.

By Rusticus.

All our turnips this year, (Godalming, (1835,) are destroyed by the *blacks;* and I begin to think that these are the real turnip-*fly*, the smaller animal being only the turnip-*flea*. About the middle of July these real turnip-flies were showered down on us, as it were from the clouds; they fell thicker than rain drops, and hovered about the turnips in such myriads that the whole fields were coloured with a rainbowy tinge, when the hot sun shone on the filmy gauzy wings of the flies. I will give you an entomological description of one of these flies:—the head and antennæ are as black as a coal: the thorax is yellow before and on the top, but coal black on the sides and behind: the body is yellow: the wings are clear and very shining, and tinged with yellow, and the upper ones have a dash of coal black along the upper margin, which reaches three quarters of the way from the thorax to the tip of the wing: the legs are yellow, spotted with black. I could not find that these flies tasted the turnips; they only came to them on family business.

About the 9th of August the turnips began to look queer; the flies had disappeared almost entirely before this, you must recollect. One Saturday I looked well over them, and found they were swarming alive with little black caterpillars. I told two or three men who were hoeing them that the turnips looked bad, and I showed the grubs to them, but they thought nothing of it, and I found I could not persuade them that any thing was the matter. On Sunday I could not get out as far as a turnip-field. On Monday I went out and the turnips *were not:* they had in two short days been swept from the face of the earth. The land was every where as bare as on the day it had been sowed. There was no speck of green for the eye to rest upon. It was a wild and universal desolation, and the black, crawling vermin that had caused the ruin were clustered in bunches on the ground, and on the remnants of the turnips, and were dying of starvation. No plague of Egypt could have been more effective: the mischief was complete. Some few fields received the blast a few days later than others, but all had it; not one escaped unless the crop were Swedes, and it is remarkable that these were untouched. I need not tell you that I boxed some of the grubs, to learn something of their history, but have not progressed in the affair yet. I am certain the grubs are the produce of the fly; the eggs

* Philosophical Magazine, No. 35.

were laid on the young leaves of the turnips, and hatched and turned into grub. The build of the grub proves beyond a doubt that it is the larva of the fly. It is rather rough coated but without hairs; it is of a dull leaden sort of black colour, and has a lighter line along each side; it has twenty feet. It is fond of resting on the leaf curled up in a ring, and if disturbed tumbles on the ground without opening; indeed, if not in a ring before, it rolls itself into one when touched. I send you a pen and ink sketch both of the grub and fly. The grub is the natural size; the fly is of the length and breadth of the cross below it: the parts I have left white are yellow. I think I have done it accurately enough for you to tell me the name.* I find, on referring to the accounts of the enemies of turnips, that these *blacks* were well known formerly, but the race seems to have become extinct and forgotten. I find a hundred recipes for their destruction, all of which are moonshine, except one, which is for a wonder rational. It is this: buy an immense lot of ducks, and turn them in your turnips, and they will devour the grubs by millions, and become in a few days as fat as butter. Thus two birds are killed with one stone—the ducks fatted and the turnips saved. When we get on a little further with our inquiries into the history of animals, especially such little things as insects, you may depend upon it we shall find the best way to check the increase of any hurtful kind is to encourage any other animal, beast, bird, fish, or insect, that makes the injurious one its prey. You see Providence has foreseen that the earth might at any time be desolated, actually unpeopled, by the natural increase of many kinds of insects, and has provided against it. I have calculated that the common tiger moth caterpillar is every year produced in this island in sufficient numbers to eat up every green leaf or blade of grass; to starve all our sheep, cows and horses, and so to deprive us entirely of either animal or vegetable food. You know this caterpillar eats almost every thing; well, of all caterpillars this has the most parasites, so many, that not more than one egg out of fifty thousand produces a moth; thus its voracity and its productiveness are rendered harmless. I'll be bound you would laugh when I tell you I breed lady-birds on purpose to destroy aphites; but it is true, and I assure you it answers capitally. You may depend on it the blacks have some natural enemy besides ducks: if not, ducks would do very well, except that the demand for ducks would be greater, I fear, than the supply; but a farmer, especially if he has water, ought to keep an immensity of ducks, they are always *useful*, as they eat such lots of slugs and other vermin, and if within a moderate distance of London, always *saleable* at a paying price.†

* The insect described is the *Athalia spinarum* of most entomological cabinets, but is described by Stephens as the *Tenthredo centifolæ* of Panzer; *Athalia centifoliæ*, Stephens.

† Entomological Magazine, No. 14.

STRUCTURE OF THE NERVES AND BRAIN.

According to Ehrenberg the cerebral mass consists of parallel tubes expanding in a varicose manner, and converging to the base of the brain. The brain is a system of capillary vessels similar to the nerves. The nerves of sensation and the sympathetic nerve consist of soft, cerebral, medullary matter; the latter surrounded by nervous tubes. These may be termed jointed nerves (nerves of sensation.)

All other nerves consist of tendinous, cylindrical tubes, formed of a peculiar medullary matter, which may be called tubular nerves, (nerves of motion.)

The nervous medullary matter is absent in the brain and jointed nerves.

The structure is the same in man and all vertebrated animals. In the inferior vertebrated animals, the soft, cerebral matter is observed in small quantity, while the tubular substance is abundant.

In the vascular net of the cortical substance of the brain, large globules are scattered, which are proportional to the globules of the blood.

By the aid of powerful instruments, Krause has been able to observe in the cerebral and nervous substance small fibres, which partly run in a winding manner parallel to each other, and cross each other, partly obliquely in such a way that they can be traced through their crossings. The first appears especially in the longitudinal clusters in the base of the brain, the latter in the limits of the white and grey substance of the brain. These fibrils have generally a diameter of 1·400 to 1·640 of a line, but at intervals they swell into knots which are 1·200 in thickness, and consist of an extensive, tough, transparent substance, soluble in water, and of spherical, slightly transparent, white, nervous globules, which possess a diameter of from 1·640 to 1·800 being roundish or oblong. In the thin fibrils the globules lie in one row, but in the thicker fibres two or more are arranged abreast without forming regular rows. In many parts of the nervous substance, as in the slices of the cerebral mass, few or no parallel fibres are detected, while globules either of a cylindrical or elliptical form may be observed. In the grey matter the globules are heaped together, and occasionally may be noticed transverse fibres, or their curved oblique courses traced. The knots of the fibrils Ehrenberg considered to be bladders. Krause, however, concludes that the fibrilli are sold cylinders and not tubes, because in the globules magnified 1000 times, he saw an outer border of the circuit, and on the cut edges of the brain and nerves which contain longitudinal and transverse fibrils, and therefore must be cut through. He never could observe light by magnifying to the highest degree, and by every possible change of illumination.

He considers water an improper medium through which to

view the globules, because, as in the blood, their form is altered by that fluid, and he recommends the fresh serum of the blood and water holding in solution albumen.

Professor Ehrenberg, in answer to Krause, states that he has made observations with and without water upon the nervous substances, and by the aid of an instrument much more powerful than that employed by Krause, and has found them steady, and still adheres to the opinion that the fibrilli are tubes.*

ISINGLASS.

FROM the experiments made by Mr. Smith in the United States, it appears that the intestines of the fish the *gadus merluccius* furnish the purest species of isinglass, (*Journ. de Pharm.*) not inferior to that obtained from the sturgeon. The swimming bladder of this fish is larger than that of other species of the same family. It is cut out and washed with pure water, and then dried in the sun. When partially dry it is pressed between wooden rollers as thin as paper. The long stripes of isinglass which are met with in commerce, are the intestines of the *gadus morrhua*.†

NOTES ON THE GENUS APHIS.

By Francis Walker.

LATREILLE separated the genus *Aphis*, Linn. into three divisions, which he thus characterized :—

I.—Abdomen bicorniculatum. Antennæ setaceæ, elongatæ.

II.—Abdomen bituberculatum. Antennæ sæpe filiformes.

III.—Abdomen corniculis tuberculesque nullis. Antennæ filiformes, breves; corpus in multis tomentosum; insecta sæpius in gallis improprie dictis degentia.

Lachnus, Illiger comprises the second division, and the genera *Myzoxyle*, Blot, and *Phylloxera*, Fonscolombe, probably belong to the third, which Burmeister describes as *Chermes*, Linn.

Aphis.—This genus is still very extensive, and in some instances includes two distinct species, that feed on the same plant, so that a subdivision is required to avoid confusion, for most species are as yet only described by the names of the plants which they infest.

I. Horns of the abdomen very short, body generally small and narrow. Among the species of this division are :—

1. *Aphis* of the lime.—The prettiest species of the genus, is found in all stages of growth under the leaves of lime trees, during the summer and autumn. When full grown it is bright yellow or green, the scutel and sides of the head and thorax are black, and two rows of black spots extend along the sides of the abdomen; the antennæ have alternate rings of yellow and black; the hind thighs are black; the wings white, spotted with

* Poggendorf, quoted in Thomson's Records, No. 3.

† Thomson's Records, No. 3.

brown at the tips of the nervures, the costa also brown. The young ones are entirely pale green and semi-pellucid.

2. *Aphis* of the oak.—It is a small, delicate, green species, having sometimes, but very rarely, a bright yellow hue; the joints of the antennæ and the horns of the abdomen are tipped with brown or black; the latter are very short; the feet also are brown, the wings colourless, with a broad pale green fore border, the nervures usually varied with black. It is found in June beneath oak leaves, and has some likeness to the lime *Aphis*, but the larger size, gayer colours, and embroidered wings of the latter easily distinguish it.

3. *Aphis* of the hazel.—This also is a very pretty species. The body, antennæ, legs, and wings have a pale lemon colour; the eyes, the feet, and a dot on the fore border of each upper wing are brown. It is rather larger than the preceding, and is found in June beneath the leaves of the hazel.

II. Horns of the abdomen long, body generally broader and more convex. The nervures of the wings are variable in some species.

1. *Aphis* of the cabbage.—Very abundant in all stages of growth beneath cabbage leaves in August. It is thickly clothed with white down.

2. *Aphis* of the white water-lily.—Found in August on the flowers of that plant. When full grown it is entirely black, and has limpid wings with green nervures; the young ones are paler.

3. *Aphis* of the cherry.—It swarms in May beneath the leaves of cherry trees, which it causes to curl up and become covered with a glutinous matter. It has a dull red colour when very young, but on arriving at maturity it becomes black and shining, with the tibiæ and third joint of the antennæ white. The body is broader and more convex than that of most of the genus. The wings are alike in colour to those of the preceding species, but the arrangement of their nervures differs.

Lachnus. Some of the larger species of this genus have the penultimate nervure of the upper wing subdivided. They usually inhabit the trunks and young shoots of trees, and among them are *Aphis piceæ*, Fabr., *A. quercus*, Linn. and *A. pini*, Linn. On a warm cloudless morning in October I saw myriads of *Scatopse picea* hovering about and settling on a larch tree, near Dolgelly, North Wales; and among them were two or three *Scatopse flavicollis*. They came to feast on the honey distilled by a colony of *Aphides* that infested a branch of that tree. These latter were of all sizes; the young ones greenish brown, the full grown deep brown, and speckled with white. They were rather darker than *Aphis pini*, but probably not a distinct species. The smaller species have the penultimate nervure of the upper wing simply bifurcate, and inhabit the leaves of plants, &c. One very minute species is found in company with the

Aphis of the oak described above. It is dull brown, oval, very flat, the wings limpid, and crossed horizontally over the abdomen, the costa pale green, the nervures darker.*

APHIS PERSICÆ.

M. MORREN has presented a memoir on this insect to the Academie Royale des Sciences of Brussels. It was borne in a hurricane over many parts of Belgium, during the autumn of 1834. The emigration appeared to commence between Bruges and Gand, and from this place, as a centre, extended to the north-east and south. A single individual is able to produce 10,000 as early as the second generation. The female has an ovary of eight *ovi* or *fœtigerens* sheaths, according to the season. These sheaths have each three or four apartments, where the young are gradually developed. When in the egg state they are seen in the terminating apartments. M. Morren believes that there is an individualization of organized matter in this and allied species. The saccharine matter is the nourishment of the young ones in their earliest stage of being, so that the insect may be called one of the *Mammalia*.†

ANIMAL HEAT.

BECQUEREL and Breschet are at present engaged in a series of experiments upon this subject. Their mode of determining the temperature of different parts of animal bodies is by means of a thermo-electric multiplier, with needles and probes formed of two different metals, soldered in certain points only.

The needles are of two kinds, the most simple being composed of two other needles, the one of platinum, or copper, the other of steel, soldered at one of their extremities in the direction of their lengths, each of them being about half a millimetre (0·0196 inch) in diameter, and a decimetre (3·93 inches) in length. One of these needles is introduced into that part of the body whose temperature is to be determined, the soldered part being placed in the same medium. The two free ends are then made to communicate with the wires of the multiplier. The points of junction, platinum and copper, steel and copper, if the platinum and steel needle is employed, or the points of junction of steel and copper, if the steel and copper needle is employed, are placed in melting ice, in order that the temperature may remain constant. The magnetic needle then deviates, in consequence of the difference of temperature which exists between the point examined and zero. Experience shows that the maximum effect is found between 0° and 25°; therefore, before commencing the experiment, the multiplier may be so adjusted that the needle

* Entomological Magazine, No. 14. † Ibid.

shall stand between 20° and 25°, in order that the most minute deviations may be noted. When the magnetic needle has acquired a fixed equilibrium, the probe is withdrawn from the part examined, and the corresponding soldered part is plunged into a water-bath, of which the temperature is raised until a deviation is produced, considerably, above that which was previously obtained. The water is allowed to cool, and the temperature corresponding to this deviation is marked by an excellent thermometer.

From these experiments it appears that, 1. In man the temperature of the muscles exceeds that of the cellular tissue by 4° and 2°¼. 2. The mean temperature of the muscles of three young persons, aged 20 years, was found to be 98°·186. With the common thermometer, Dr. Davy estimated the heat of the human body at 98°; and Despretz found the mean temperature of nine men, aged 30 years, 98°·85; of four men, aged 68, 98°·83; of four men, aged 18 years, 98·58. While John Hunter found the temperature of the rectum of a healty man between 97° and 98°.

3. The mean temperature of the muscles of several dogs is 100·94; while Despretz makes it 103°·06. This difference may be attributed to accidental circumstances. It is to be observed, also, that the state of the health has an effect upon the temperature. The temperature of the brain was 100·85: this temperature was suddenly reduced some degrees, and in a few minutes the animal died.

4. The temperature of the common carp was only about 9·10 of a degree above that of water.

5. The contraction of the muscles augments the temperature, while the compression of an artery diminishes the temperature. Agitation, motion, and in general every thing which determines a flow of blood, tends to elevate the temperature. Whether the nervous system has any share in producing a rise of temperature remains to be determined.*

THE WASP.

On February 27, a paper was read before the Ashmolean Society of Oxford, by the Rev. E. T. Bigge of Merton College, on the natural history of the Wasp.

The object of this paper was to correct the mistakes into which several writers have fallen, and to state the results of the author's own observations on two species, the Vespa Vulgaris and Vespa Britannica.

* Ann. de Chim. et de Phys. lix. 113. (It is to be regretted that the authors do not mention the season of the year when these experiments were made; for, as has been remarked to me, by a distinguished comparative anatomist, the relative temperatures of fishes, and the medium in which they are placed, vary according to the season.)—Thomson's Records, No. 11.

The former is common in all parts of the kingdom; the latter, though occasionally met with in the southern counties of England, is abundant in the northern districts, and in Scotland, as well as in the northern parts of Europe. The V Vulgaris of Linnæus is the V Britannica, the French having called that species *vulgaris*, which was most common, and which formed its nest in the ground. The V Vulgaris of the present entomologists is the V Gallica of Linnæus.

Leach gave the name Vespa Britannica to the tree wasp. The points of difference between the two species are as follow:—

1. The tree wasp (V Britannica) has a reddish-brown spot near the point of insertion of the wings, which is seldom visible in dried specimens.

2. In the males and neuters the base of the antennæ is yellow on the outer side, instead of being entirely black, as on the ground wasp, but the females often present exceptions to this distinction.

3. The tree wasp has two yellow spots on the back part of the corslet, while the ground wasp has from four to six.

4. The spots on the abdomen of the tree wasp are not so much detached from the black bands as in the other species, and less so in the males than the females. Linnæus drew a distinction between the hornets (V Crabro) and the true wasps, founded on these marks, which cannot be considered as decisive, because they vary in different individuals.

5. The tree wasp has more black upon the body generally than the other species.

6. The tree wasp is rather larger. 7. The organs of generation in the males of the two species vary considerably. 8. The abdomen in each species contains the same number of rings, viz. six in the females and neuters, and seven in the males.

Mr. Bigge states some interesting facts in illustration of the natural history of both species. Societies of wasps, as of bees, consist of three different classes of inhabitants, males, females, and neuters. The females, which are much larger than the others, are the large breeding wasps which appear in the spring. The neuters, or imperfectly developed females, are the common wasps which infest our houses and gardens, and form the majority of the colony. The males, about the size of the neuters, have longer antennæ, a more slender form, and are destitute of a sting. The females, which alone survive the winter, early in the spring, having fixed on a suitable place for a nest, form a few cells, in which they lay the eggs of neuters only. Each nest is the work of a single female. The nests are often suspended from the beam of a shed, from the eaves of a house, from the branch of a young tree, or in a thorn hedge.

Mr. Bigge has observed them in the Scotch fir, elm, and beech, very frequently in larch trees, and still more so in gooseberry bushes, but never in the silver fir, as stated by Mr. Rennie.*

The nest consists of from ten to sixteen layers of a paper like substance, procured principally from fir wood, and disposed one over the other in such a manner that each sheet barely touches the next. This

* I have frequently observed nests situated on wild rose bushes (Rosa *tomentosa and canina*,) in Scotland. The choice of these shrubs by the wasps is probably to be ascribed to the facilities which they afford for obtaining food.—Thomson's Records.

structure enables it to resist the heaviest rains. In its earliest state it does not exceed an inch in diameter, and contains five or six cells only.

It is formed of two semicircular layers of the paper, the upper one projecting a little over the other, so as to shoot off the rain, a hole being left at the bottom large enough to admit the female wasp. As soon as the first workers quit their cells they begin the task of enlarging the nest, and of adding fresh layers of cells, in which the female immediately deposits more eggs. Mr. Bigge states that the nest is enlarged from one inch to twelve in diameter, and considers that Leach is in error when he affirms that wasps build two nests in the year.

Is not the loose structure of the external covering intended to facilitate its expansion?

The egg is hatched in eight days, and then assumes the form of a grub. It is then fed by the female for thirteen or fourteen days, when the grub covers the mouth of its cell with a silky substance. It remains in this state for nine days, and then eats its way through the covering, and joins the rest in the labours of the nest. As soon as the neuters are hatched the care of feeding the larvæ devolves upon them. The males appear to employ themselves in cleaning and preparing the cells for successive broods.

Mr. Bigge has never found, in any single instance, a male larva in the cells appropriated to females. He has repeatedly found male grubs in the upper layers, which are devoted to neuters, but never the contrary. The beautiful arrangement by which the layers in the nest are attached to each other so as to allow room for the wasps to walk between them deserves attention. In the ground nests the supports or braces are round, like small columns, and dispersed at irregular distances. The upper end is spread along the edges of three cells so as to divide the pressure, and yet allow room for the grubs to work their way out when they are come to maturity. In the tree nest, instead of pillar like braces, thin slips of the paper of which the whole nest is composed but made stiffer for this purpose, are continued along the edges of a number of cells, so as not to interfere with the inmates, and are finally fixed to the layer below.

The author has never seen a nest of either species, in which he did not observe after nine o'clock in the summer months, a sentinel watching the entrance to the hive. He has sometimes thought, that he could discern a second sentinel, behind the first one. A lantern held near the sentinel does not disturb him, but on touching the ground near him, he instantly disappears for a few seconds, and the inhabitants sally out immediately. Several wasps pass the night in summer on the outside of the tree nest, but the sentinel is notwithstanding always at his post.

The ground nest has two apertures, one for entry and the other for exit. The tree nest has usually only one, but in large colonies there are two, at each of which a sentinel is stationed. It is curious, that if we stop up a wasp's nest, the returning wasp will not sting the aggressor, while those which escape from the inside will attack him instantly. The grub of a species of volucella is found in the nests of wasps. An ichneumon as large as the wasp itself, with a black head, yellow abdomen with a dark streak down the back, black legs and under wings, and dusky upper wings has been observed by Mr. Denison, and another, (Anomalon Vesparum,) by Mr. Wood.*

* Thomson's Records, No. 6.

OBSERVATIONS AND EXPERIMENTS, PROVING THE PARR, OR BRANDLING TO BE THE YOUNG OF A VARIETY OF THE SALMON.

By Mr. John S. Milton, Surgeon, Communicated by Dr. Knox.

INDIVIDUALS acquainted with the rivers of this country, have long been aware that many varieties of the salmon exist in these waters, such as the *Salmo salar*, or common salmon of the market; the *grilse*, the *sea-trout;*—and, about their mouths, the *whitling*, and the *yellow-fin,*—some of which are presumed to be the fry in an advanced state of growth, as the *yellow fin* and *grilse;* and others, as the *sea-trout* and *whitling*, are known to be found with milt and roe, in a condition for spawning, and supposed to be distinct varieties of the genus.

Of the young or fry of all these, we know little farther than that, at a certain period, and for a short time, vast numbers of small fish, of similar aspect, and passing under the designation of *smelt* or *smoult*, are found in the streams where the various species of salmon have spawned, and under those names are protected from destruction by the authority of the legislature. But in consequence of scientific persons having been unable to prove that the shoals of small fish called *brandlings* or *parrs*, are the spawn of the salmon genus, no protection is provided for them in our act, and millions are annually destroyed by the anglers alone in their sport.

The consequence is, a yearly decrease in the supply of salmon, naturally induced many persons connected with the fisheries, to attribute the failures to the destruction of the spawn; and Mr. Peat, the farmer of the Earl of Lonsdale's fisheries, on the Derwent, instituted some experiments on the *parr*, something similar to those made by Mr. Hogg, on the part of the Yarrow, and had invariably arrived at the conclusions that this little fish became larger, descended to the sea, and returned, in process of time, of considerable weight, size, and of excellent flavour, when it was sold as a salmon in the markets he supplied.

The relation of these circumstances to me by Mr. Peat, induced me not only to make them known to the public, but also to collect a considerable mass of corroborative evidence from other sources, and to pursue some anatomical inquires on the *brandling* or *parr*, which were all equally conclusive of its growing to be a salmon of a species which I shall endeavour presently to point out.

A curious and interesting accidental occurrence furnished a gentleman, Mr. Harris, of the Goat, near Cockermouth, with an opportunity of placing it beyond dispute, that the *brandling* or *parr* is hatched from the ovum of the salmo. On digging into some sand-beds in the Derwent, during the latter part of a dry summer, that gentleman found, near the surface, innumerable

parr lying dead, and varying in size from two to three or four inches. On proceeding farther down, he discovered to his surprise the *parr* of smaller size attached to such large ova as must have belonged to a salmon or large salt water fish alive, although in gravel only just moist. The deeper he dug the less the fish became; and, at the depth of a yard, he found thousands of the impregnated ova, in all stages of progression towards the fœtus, being hatched. In some only the eyes were visible; in others the eyes and the spinal column, coiled up in the egg; and, in many, the diminutive creature attached to it by the cord.

Some of the largest of these attached to the ova, and some of those separated from it, Mr. Harris collected, placed in a washing-tub, and kept alive for several weeks. They presented to the most careless observer, the lateral bars or *finger-marks* of the *parr*; and out of the many persons who resorted to see them, no one ever pretented to dispute that they were the fish so abundant in that river, under the name of *brandling*, and so plentiful in the salmon rivers of Scotland as the *parr*.

I could advance many more instances of a similar kind, where individuals have had the truth forced upon their notice by accidents and circumstances, the importance of which it was impossible to deny. But as I feel assured I have simply related a few facts proving the *parr* to be the young of a larger fish, which cannot be denied, I shall endeavour to show that it is the young of a variety of the salmon frequenting our streams.

In the first place, negative evidence acquaints us with the curious facts, that *parr* are never to be found in rivers unfrequented by salmon; and, although Dr. Knox has proved that they do not now exist in the Whitadder, where *some* species of salmon abound, they yet always may be discovered in the waters inhabited by *all* our varieties of the salmon.

An excellent example of this occurs in the Derwent and the Ellen, two rivers of Cumberland, both discharging their waters into the Solway, within five miles of each other. In the Derwent, every variety of the salmo abounds: and there the *parr* is found in innumerable shoals. But in the Ellen, where only the square-tailed fish, commonly called the sea trout, locates, no individual ever beheld a *parr*, although, in the spring, the smelt of this sea-trout is plentifully caught.

I am aware that it has been asserted, that, somewhere in the Western Isles, *parr* are found, and not salmon; yet I beg to submit to consideration, that these streams may have been very partially examined, and that they may assimilate to some of the small rivers which I have fished in Yorkshire; where, owing to the minuteness of the stream, the salmon frequently only make their way a short distance up from the coast, deposit their roe, and disappear immediately; and in these streams, at a great

distance up towards their insignificant sources, I have caught abundance of *parr*.*

From attentive consideration to these points, and from all the information I could ever collect on the subject, I am disposed to believe that, wherever all the varieties of the salmo genus abound in any one river, we shall there certainly have the *parr*; and I hesitate not to challenge a refutation of this assertion, by clearly defined and substantiated proofs. If this be admitted, then we arrive at the conclusion, that the *parr* is, in some measure, connected with the salmon, and, as I have proved, the young of one of its varieties; and it only remains to determine to which species it belongs.

In the second place, the positive evidence of most of the experiments which have hitherto been performed upon the *parr*, prove that it becomes a larger fish, descends to the sea, and returns, after a certain period, of various sizes and appearances.

The grandfather of the present proprietor of the Derwent Fisheries, so long ago as the memoriable year 1745, commenced marking the brandlings and smelts occasionally caught about his fisheries; and ever since that period, first his son and then his grandson, continued to mark them, by removing the dead fin, back-halving and fore-halving the tail, and invariably succeeded in having some of them, at subsequent periods, for sale on their fish-stalls when arrived at a considerable size, and weighing about 20 lb.

Such results, however, led to very little knowledge of the disputed points; for I must observe, that while Mr. Hogg, and others call the fork-tailed fish the salmon of the Tweed, Mr. Peat, declares the square-tailed fish to be the real salmon of the Derwent, and showed me a drawing of one upwards of 70 lb. weight. The gilse or grilse of Cumberland is fork-tailed—the *sea-trout* square-tailed, but seldom reaching a weight of 12 lb.: whereas I myself lately forwarded to Dr. Knox the vertebral column of a salmon of 25 lb. weight, in which the tail was as square as if formed by a rule.

While such differences of opinion as these exist, I cannot pretend to offer an assertion as to the *name* of the exact species of salmon which the *parr* becomes.

Under all these difficulties, I resorted to dissections of the fishes, with the impression that the deep anatomy could certainly furnish me with some conclusive results; and I have had the proud satisfaction to discover that my surmises were not altogether incorrect.

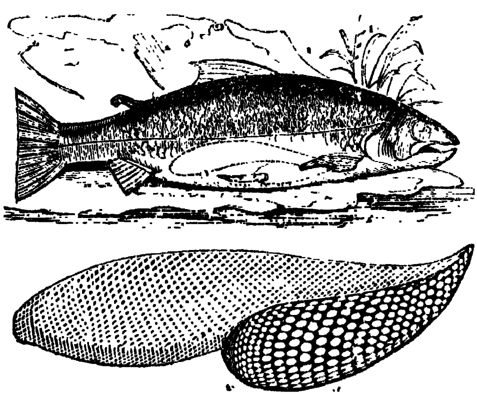
The number of rays in the fins, considered by naturalists likewise of so much importance, I do not myself attach the slightest regard to, as some of them are so cartilaginous and indistinct, that I am not sure if any two persons can number the

* I never thought that *parr* had been observed near the *sources* of rivers.—Dr. Knox.

same; and in the infant fish, of course, it is impossible to count them; and even when we can, there appears nothing, structural or numerical, to characterize them from those of many other fish, and all the varieties of their own kind.

Accordingly, I looked to the feeding of the animals, and the structure of their generative organs, to afford me some clue; and on proceeding with my examinations, I was astonished to find, that while the stomachs of the square and fork-tailed salmon, called in Cumberland, salmon and grilse, were invariably apparently empty, the stomach of the sea-trout was just as constantly stuffed with flies, worms, and other particles of common and gross food, which induced me to set it aside as a coarse feeding variety. But the remarkable similarity of habit, in the feeding of the others, led me to examine minutely the structure of the fork-tailed salmon (the grilse), and of the square-tailed or common salmon, expecting to find their deep anatomy precisely the same, although the superficial anatomy displayed the broad difference of the fork and square tail; but, to my great astonishment I found a marked and perfect distinction in the generative organs, where I looked for them agreeing in every respect.

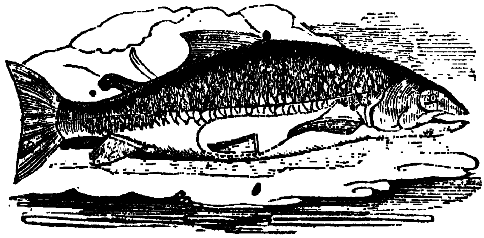
In the square-tailed salmon I found two beds of roe of *unequal length* lying *one below another*, as represented in this figure, sketched from a fish of 25 lbs, and containing ova of *unequal*

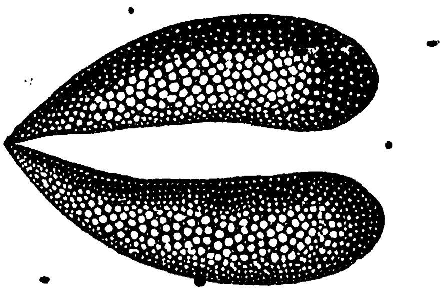


magnitude, the short bed being only one-half the length of the long one, but containing an egg of double the size. On inquiring of Mr. Peat, who had been accustomed to open thousands of fish, he told me that the beds of roe *invariably* differed in size and lay one below the other in the salmon, but that at a certain period of gestation, the ova became *more nearly equal in their bulk*.

In the generative organs of the fork-tailed salmon, precisely

the reverse of this order is displayed. There two beds of roe are found of *equal length*, and lying *parallel to each other*, represented in this figure.





Of course, I immediately procured and dissected a number of *parr*, and there I found exactly what I expected, that this little fish, which in its superficial anatomy precisely resembles the fork-tailed salmon, resembled it as closely in the structure of its generative organs, having the two roes lying in equal and parallel beds. The roe is rudimentary, and the ova must be seen through a magnifying lens at certain seasons; but during the autumnal months, the beds have arrived at such a growth, that the ova may most distinctly be seen and counted with the unaided eye, and in this advanced condition I presented some to Dr Knox a short time ago.

These, I think, it must be allowed, are essential and marked features in the anatomy of an animal, which are too momentous to be lightly thrown aside. I consider that every known circumstance of the habits of the *parr* proves it to be the young of a migratory fish like the salmon; and I see in the anatomy the most pointed dissimilarity from every fish in the river but one, and to that I find it approximates so closely, or rather resembles so precisely, that I must now venture to pronounce it to be the young of a variety of the salmon, a fish that, in the rivers of Cumberland, attains a great weight and fine flavour; and which, when taken out of the Tweed, is, I understand, sold in Edin-

burgh Market, under the general designation of salmon, and considered the finest description of fish.

If, then, these curious facts cannot be disproved, it will no longer be considered extraordinary that the supply of salmon should have decreased from rivers, in the neighbourhood of which no adequate increase of population accounts for the difference. On the Derwent, there cannot now be taken a tithe of the fish formerly caught. But it is an ascertained fact, that the brandling or *parr* is, as the salmon decreased, not only more closely sought after by the angler, but more fearfully devasted by the poacher with his nets.

If, however, this fish were preserved by the authority of the Legislature, and the privileges of the angler in a compensatory degree enlarged, the results would in every probability be satisfactory in the extreme. Learned societies can, either by a recognition of the truth of these statements, determine the *parr* to be the young of a variety of the salmon, and by so doing, show the importance of the inquiry to the Legislature of this country; or by instituting a series of experiments, which I can assure them may be performed at a very trifling expense, possess the means of placing the matter for ever beyond dispute.*

RESPIRATION OF BIRDS.

In a paper read to the French Academy of Sciences, by M. Emili Jacquemin, the author comes to the following conclusions: 1. Organized beings exhibit three principal modes of respiration. The first consists of a simple and simultaneous gaseous exhalation and absorption, gentle and continuous; the organized portion remaining passive and motionless; this mode of respiration is seen in plants. In the second, there is established an excessively rapid attraction and repulsion between the organized parts and the surrounding medium, whence a vibration results on the edge of the respiratory organs. Such is the respiration of a great number of the Infusoriæ, the Vorticellæ, the Kalpodes, the Leucophylles, the Rotiferæ, &c.; and amongst the animals of the radiata, the Plumatelles, the Acalephes; among the Mollusca, the Planorbes, the Lymneæ, the Uniones, and the Anodontes. In the third mode of respiration, the reciprocal action of the organized parts and the surrounding medium goes on in determinate intervals, separated by a moment of repose. Such is the respiration of the higher animals.—2. In birds, the air penetrates not solely into the lungs, and about the parietes of the chest; it also enters by foramina not very determinate, into eight pneumatic pouches, which occupy a large portion of pectoro-abdominal cavity.† Thence it penetrates into subcutaneous cellules, by means of the subscapular and subfemoral pneumatic

* Abridged from the Quarterly Journal of Agriculture, No. 29.

† The *air-cells* of English anatomists.

pouches, and through the apparatus already described into the superior and inferior extremities.—3. The pneumatic pouches are so placed, that they can easily conduct the air into the more solid parts of the body, and may in this way surround the heaviest viscera, so that it supports birds during their flight, and thus contributes to facilitate their aerial locomotion.—4. The large quantity of air which thus finds its way into the most internal parts of their bodies, tends to dry the marrow in the interior of the bony cavities, and also a portion of the fluids which it encounters in its passage; hence results a diminution of the specific gravity of birds, the true cause of which has in vain been sought for in the quantity of air alone which penetrates into their bodies.—5. In birds, the oxidation of the nutritive juices is effected not only in the lungs, but is much promoted also in the pneumatic pouches. The air contained in them operates, through the membranes, upon the sanguiferous and lymphatic vessels with which they are in contact; hence there follows a far more complete and speedy oxidation.—6. Not the skeleton only, but all the viscera also, which go to form the body of birds, are much more permeable to air than they are found in any other of the vertebratæ.—7. The reservoirs for the air are not always symmetrical; their form and extent depend entirely upon the form and reciprocal situation of the organs among which they are placed. All that seems to be fixed is, that the total quantity of air received in these pneumatic pouches, on the right side of the body, is equal to that received on the left. Unless this condition were maintained, flying would be impossible, and walking would be difficult.—8. No portion of the structure of birds, including even the last phalanges of the wings and feet, and the last caudal vertebræ, is impervious to air. The quill of the feathers makes no exception to this, as has sometimes been alleged. —9. The air within the head has a distinct circulation, and does not communicate directly with the air-passages of the rest of the body.—10. In no part is the air in immediate contact with the viscera or the nutritious juices; it is invariably only through a membrane, how fine and transparent soever it may be. This fact would go, by analogy, to establish, that the air filling the lungs, even to the last ramifications and ultimate cells, comes in no other way in contact with the blood, in its ultimate vessels, than through a fine and delicate membrane, as thus happens in birds. —11. The large quantities of air which birds can thus introduce into their bodies, and the force with which they can again expel it, is the only consideration which can explain how so small a creature as the nightingale, for example, can produce notes so strong, and can sing so long and so delightfully, without any apparent fatigue.*

* Jameson's Journal, No. 37.

NEW AND RARE FISHES.

On April 4, was read to the Wernerian Society, a communication from Mr. R. H. Parnell regarding some new and rare fishes which he had procured from the Frith of Forth. In addition to the ample list of fishes found in the Forth, given by Dr. Neill, and published in the *Transactions* of the Society, the author has detected nine others, two of which are new to science; one he referred to the genus Solea, the other to that of Platessa,

New Species of Sole.—This evidently enough belongs to the family Pleuronectes, but perhaps can scarcely find a place in any genus at present known. It varies much in shape, sometimes resembling a Brill, at others a Sole; in character it mostly resembles the genus Solea, in having the teeth deficient on the eye side, but in consequence of the mouth not being twisted, and the whole fish covered with a strong cuticle, it cannot be placed in that genus; it differs from all the other genera in having the teeth deficient on the eye side. When recent, length sixteen inches, breadth nine and a half, and one inch thick; mottled with white, yellow, and brown; the lateral line arched, two inches in length, and a quarter of an inch in breadth over the pectoral fin, from thence running straight to the tail. Jaws equal, each furnished with a row of obtuse cutting teeth, very closely set together, extending but half way round, and being deficient on the eye-side. The first two teeth on the lower jaw on the eye-side are the largest, and a little apart from the others; the eyes are large, situated on the right side, the irides of a light yellow colour; pectoral fins with nine rays; ventral fins five, anal fin seventy-three. Dorsal fin ninety rays, the first commencing over the eye, and running within half an inch of the tail; caudal fin rounded at the end, with sixteen rays. The whole fish is covered with a strong cuticle, rendering the scales very adherent, and the whole surface smooth. The first specimen which Mr. Parnell observed was in February last, which he sent to Dr. Greville, who made an accurate drawing of it. In March he found them more plentiful, and in April they entirely disappeared; they are known to the fishermen by the name of French Sole," and appear to be confined to the Fifeshire coast, where they are taken with the hook on the fine sandy banks.

New species of Platessa.—This fish seems much rarer than the last, as Mr. Parnell, has not had an opportunity of observing more than two specimens. It agrees with the genus Platessa, in having the mouth entire, with a row of obtuse cutting teeth round each jaw, tail rounded at the end, and the eyes placed on the right side. It differs from the Platessa vulgaris, in having no tubercles on the head; from the Platessa flesus, in not having a band of small spines on the side line; from the Platessa limanda, in not having the scales ciliated at their margin. It approaches nearer to the Platessa microcephalus, (as a variety of which it was regarded by Dr. Neill); but it differs from it in having the lateral line nearly straight, the lower jaw longer than the upper, and the scales large. In shape it resembles the sole. Length sixteen inches and a half, breadth eight and a half, and one inch thick; lateral line arched one-eighth of an inch over the pectoral fin; eyes large, situated on the right side, irides silvery; mouth small, under jaw the longest, teeth small, closely set together; pectoral fin with eleven rays, ventral fins

with six rays, anal fin with ninety-three rays; dorsal fin consists of 109 rays, the first ray commencing over the eye, and running within half an inch of the tail; the caudal fin rounded at the end, furnished with twenty-three rays. Scales large, very deciduous; the whole fish is of a yellowish-brown colour. It is known to the fishermen under the appellation of Craig Fluke, but they appear to confound it with the last, in consequence of some similarity.

Pleuronectes limandanus.—This fish is by no means rare in the Frith of Forth; it is known to most of the fishermen by the name of Sand-necker, or long fluke. Bloch has not noticed it, under the name of Pleuronectes limandanus, as inhabiting the northern seas, but it has not as yet found its way into the works on British Ichthyology. Length ten inches, breadth four and a half, and much resembling the halibut in shape; lateral line nearly straight; mouth large, each jaw is furnished with a row of obtuse, irregular, sharp-pointed teeth, set a little apart from each other; pectoral fin consists of eight rays, anal fin of sixty rays; dorsal fin of eighty five rays; the tail forms an angle, when expanded; it is furnished with sixteen rays; scales large, ciliated at their free extremity, which renders the fish rough to the touch; the whole fish is of a brown colour. They are taken with the hook in the sandy parts of the Frith of Forth, mostly on the Fifeshire coast. The remaining species mentioned by Mr. Parnell were, Gadus mustela, Pholis lævis, Blennius galerita, Merlucias vulgaris, Trigla cuculus, and Salmo albus. A series of specimens and drawings illustrating this paper were exhibited.*

NEW BIRDS.

On April 4th, Professor Jameson exhibited and described to the Wernerian Society, a series of quadrupeds and birds. Among the more interesting of the quadrupeds were the Hylobates lar, leuciscus, albimanus, and hoolock; the latter of which, however, he stated, was probably not a true species, but the female of the Ounko of Frederick Cuvier.

Among the birds, two were described as new to science, viz. Aquila nigra, and male of Lophophorus Nigelli.

Aquila nigra—Bill yellowish-brown, length 2 inches; length of gap $2\frac{1}{4}$ inches; cutting edge of upper mandible furnished with a protuberance. Nostrils ovoid. Face between the eyes covered with stiff hairs, which radiate as it were from a centre. Body, tail, and legs of a reddish-brown colour, with the exception of the middle of the back and rump which are greyish-white: length of body from tip of bill to tip of tail, 3 feet; from the tip of one wing to the tip of the other, 5 feet 7 inches; wings about 3 inches shorter than the tail. Tail square, but rather rounded, consisting of twelve feathers, the four centre ones being slightly banded below with greyish-white; length 14 inches. Legs feathered to the toes. Toes furnished with three scutellæ, which are largest on the back one; feet yellow; claws bluish-grey. *Hab.* South America.

The Professor applied the specific term Nigra to this bird, from black being the predominant colour of its plumage, and remarked with regard to the generic name Aquila, that it belongs to that genus, of

* Jameson's Journal, No. 37.

which the type is Aquila fulva, from the cutting edge of the upper mandible being furnished with a protuberance; the wings considerably shorter than the tail; tarsi feathered to the toes; and lastly, the first phalanx of all the metatarsal bones being provided with three scutellæ.

Lophophorus Nigelli, male.—This bird was remarked by the Professor to differ from the female already described, in being larger, in having two reddish-brown bands, the one extending from the external angle of the eye, the other from the lower part of the auricular coverts, down to the under part of the neck, where they unite and form a broad diffused ring round it; in the breast being yellowish-white, and some of the feathers with a band of black in their centre; and lastly, in having the feathers of the hypochondriac region more strongly marked, and tipped with a much deeper brown. Like the female, it wants the spur. From the form of the bill, and the absence of the spur in the male, which is so prominent in the other species which have been included in the genus Lophophorus, this has now formed a new genus. The distribution of this species, the Professor remarked, was very wide, from its occurring from Persia, where the female was first discovered, onwards to the Himmalayan mountains.

On April 25th, Professor Jameson also exhibited to the above Society, a series of new and rare birds; among the latter were the *Semi-palmated Goose*, *Charadrius nigrifrons*; *Haematopus ostralegus*, from New Holland; *Otis ruficollis*, South Africa; *Tantalus plumbeus*, South America, &c. He also described an Ibis, Tanagra, and Rubecola, new to science.

Ibis spinicollis.—Bill curved, and of a brownish-black colour; upper mandible furnished at its base with 13 greyish bands, each about 1½ line in length; length 7 inches, with the upper mandible projecting over the other at the point. Nostrils linear, and inserted into a groove which extends along the bill to the tip, about ¾ of an inch from its base. Head destitute of feathers, also the centre and fore-part of the neck, to a distance of 1½ inch. Neck, fore-part covered with straw-coloured spines, on the back and upper part and sides with short greyish-white downy feathers, under with short bluish-black metallic feathers. Body, above of a brownish-black, each feather being alternately banded with dull and metallic reflections; below greyish-white. First and fourth feathers of wing longest, second and third equal; wings nearly as long as the tail. Length from tip of bill to tip of tail 3 feet 3 inches, from one extremity of the wing to the other 4½ feet. Tail square, and of a greyish-white colour, consisting of 12 feathers, length 7½ inches. Legs of a blood-red colour, feathered to about the middle of the tibia. Tarsus, length 4 inches.—*Hab.* Banks of the Murray River, interior of New Holland.

From the slender bill, the head, and small part of the neck being destitute of feathers, this bird, the Professor remarked, formed a connecting link between the two divisions of the genus Ibis, Cuv., the specific term *spinicollis* was applied to it from the fore-part of the neck being covered with spines.

Tanagra nigricephala.—Bill bluish-black, conical, and much shorter than the head; length 5 lines, gap 7; upper mandible notched at the point, and slightly hooked. Nostrils circular and naked, inserted into the base of the bill. Head of a bluish-black colour; from the outer angle on both sides of the nostril a band of bluish-black extends across the temples to the root of the neck; from the inner, one of greyish-white

extends across the ophthalmic region down to the nape. Throat white, with a bluish-black band on both sides, extending narrow from the base of lower mandible, and becomes very broad as it reaches the neck. Body, above of a suffron-yellow, approaching to siskin-green; below of a bright golden-yellow, mixed with orange. Wings of a bluish-black colour, with all the primary and secondary quills tipped with greyish-white, the first primary quill excepted; third quill-feather longest, second and fourth nearly equal, and longer than the first; upper wing-coverts bluish-black, mixed with greenish-yellow; under, yellowish-white. Tail greyish-black, and nearly square; length $3\frac{1}{2}$ inches, and consisting of 9 feathers; upper wing-coverts greenish-yellow, under greyish white; feathered to the tarsi. Tarsus, length 8 lines, and covered by 5 very broad scutellæ; middle toe 9 lines.—*Hab.* West India Islands. In the shortness and form of the bill, in the length of wings in proportion to the tail, in the arrangement of the quill-feathers of wing, the external toe united to middle by first joint, and the form and size of the scutellæ, this bird, the Professor remarked, seemed to hold a prominent place between the genus Pyrgita and Tanagra.

The Professor applied the specific term *Tytleri*, in honour of the late Lieutenant Tytler, a very active ornithologist, whose labours in India have added much to the interest of the Royal Museum of the University of Edinburgh, to a *Rubecola* which he described; and remarked, that although it agreed in the grouping of its colours with the common robin, yet, in the form of the bill, it presented as it were a link between the genus Rubecola and Phœnecura. Was sent to the Royal Museum by Lieutenant Tytler from the Himmalayan Mountains.*

THE ITALIAN TAILOR-BIRD, AND ITS NEST.

THIS bird is one of the order of Perchers, which are the best nest-builders of all the feathered tribes. They do not usually select, like the Climbers, the interior of a hollow tree or similar situations, but most commonly interweave their nests between the twigs and branches of shrubs, or suspend them from them, or even attach them to humbler vegetals; some having even exercised arts from the creation, which man has found of the greatest benefit to him since he discovered them. These birds, indeed, may be called the inventers of the several arts of the weaver, the sempstress, and the tailor, whence some of them have been denominated weaver and tailor-birds.

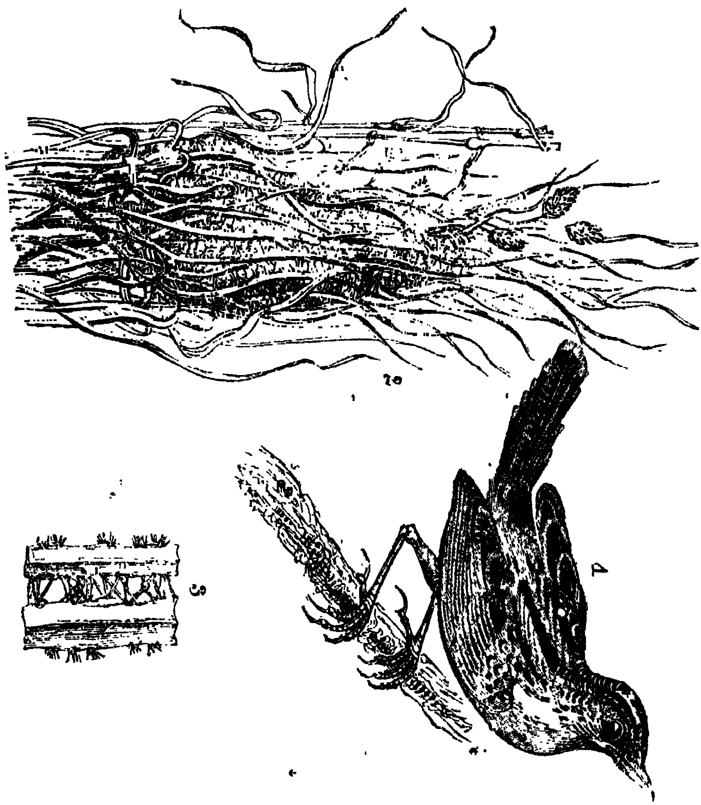
The nests of the latter are, however, most remarkable. India produces several species of tailor-birds, that are instructed by their Creator to sew together leaves for the protection of their eggs and nestlings from the voracity of serpents and apes; they generally select those at the end of a branch, or twig, and sew them with cotton, thread, and fibres. Colonel Sykes has seen some in which the thread was literally knotted at the end. The inside of these nests is lined usually with down and cotton.

But, tailor-birds are not confined to India or tropical countries. Italy can boast a species which exercises the same art: one of our most eminent ornithologists, Mr. Gould has a specimen of

* Jameson's Journal, No. 37.

this bird in his possession; and the Zoological Society have a nest in their museum; from which sources, the originals of the annexed engraving have been lithographed.*

This little bird was originally described and figured by M. Temminck, in 1820; but its singular instincts, as to its mode of nidification, were afterwards given in detail by Professor P. Savi. It is called by the Pisans, *Becca moschino*, and is a species of the genus *Sylvia*, (*cisticola*.)



1. The Bird. 2. Nest. 3. Portion of Nest, to show the stitching.

In summer and autumn it frequents marshes, but in the spring it seeks the meadows and corn-fields; in which, at that season, the marshes being bare of the sedges which cover them in sum-

* To illustrate the Rev. W. Kirby's Bridgewater Treatise.

mer, it is compelled to construct its nest in tussocks of grass on the brinks of ditches; but the leaves of these being weak, easily split, so that it is difficult for our little sempstress to unite them, and so to form the skeleton of the fabric. From this and other circumstances, the spring nests of these birds differ so widely from those made in the autumn, that it seems next to impossible that both should be the work of the same artisan.

The latter are constructed in a thick bunch of sedge or reed; they are shaped like a pear, being dilated below and narrowed above, so as to leave an aperture sufficient for the ingress and egress of the bird. The greatest horizontal diameter of the nest is about two inches and a half, and the vertical is five inches, or a little more. (*See Fig. 2 in the Engraving*).

The most wonderful thing in the construction of these nests is the method to which the little bird has recourse to keep the living leaves united, of which it is composed. The sole interweaving, more or less delicate, of homogeneous or heterogeneous substance forms the principle adopted by other birds to bind together the parietes or walls of their nests; but this Sylvia is no weaver, for the leaves of the sedges or reeds are united by real stitches. In the edge of each leaf, she makes, probably with her beak, minute apertures, through which she contrives to pass, perhaps by means of the same organ, one or more cords formed of spiders' web, particularly that of their egg-pouches. These threads are not very long, and are sufficient only to pass two or three times from one leaf to another; they are of unequal thickness, and have knots here and there, which, in some places, divide into two or three branches.

This is the manner in which the exterior of the nest is formed; the interior consists mainly of down, chiefly from plants, a little spiders' web being intermixed, which helps to keep the other substances together. In the upper part and sides of the nest, the two walls, that is the external and internal, are in immediate contact; but in the lower part, a greater space intervenes, filled with the slender foliage of grasses, the flores of Syngenesious plants, and other materials, which render soft and warm the bed in which the eggs are to repose.

This little bird feeds upon insects. Its flight is not rectilinear, but consists of many curves, with the concavity upwards. These curves equal in number the strokes of the wing, and at every stroke its whistle is heard, the intervals of which correspond with the rapidity of its flight.*

REMARKABLE SPECIES OF MUSSEL.

M. Van Beneden, Conservator of the Natural History Museum of the University of Louvain, has presented to the Academie Royal de Sciences of Brussels, a memoir concerning the ana-

* From the Mirror, No. 743.

tomy and natural history of the Driessena polymorpha, a new genus in the family of the Mytilaceæ. Pallas was the first who, in his Voyages, discovered this mussel in the different rivers of Russia, and also in the Caspian Sea. The great variety of forms under which it appeared, did not escape the observation of this naturalist, who designated it under the name of *Mytilus polymorphus*. That a true mussel should inhabit both fresh water and the sea, appeared so extraordinary to Lamarck, that he did not hesitate to regard this opinion of Pallas as erroneous. At a later period, it was discovered by Chemnitz in the Volga, and he, probably ignorant of the description by Pallas, described it under the name of *Mytilus Wolgæ*.* A long time after this, M. de Ferrussac, recognising the identity of these two species, united them in one, under the name of Mytilus Chemnitz.† But this was not all; for during this period it was alluded to by many authors, under the name which Pallas had given it, and described by others afresh under still different appellations. According to Van Beneden, this mussel is found throughout the whole of Europe, and America has specimens which very nearly approach to it. It inhabits the sea, also lakes, rivers, marshes; and all these positions appear to be equally favourable for it. Probably it is the only example in the history of mussels of an individual inhabiting so many different places and situations. The author communicates the result of his anatomical researches regarding it, which, in conclusion, he compares with the genus *Mytillus*. The name of *Driessena*, which he gives it, is derived from the name of M. Driessens, an apothecary of Mazeyk, from whom the author received, at the end of the year 1822, a collection of these mussels alive, which he found in a canal which was fed by the Meuse, and which ran between Maestricht and Bois-le-duc.‡

ON SOME BARNACLES OF THE SPECIES LEPAS ANATIFERA.

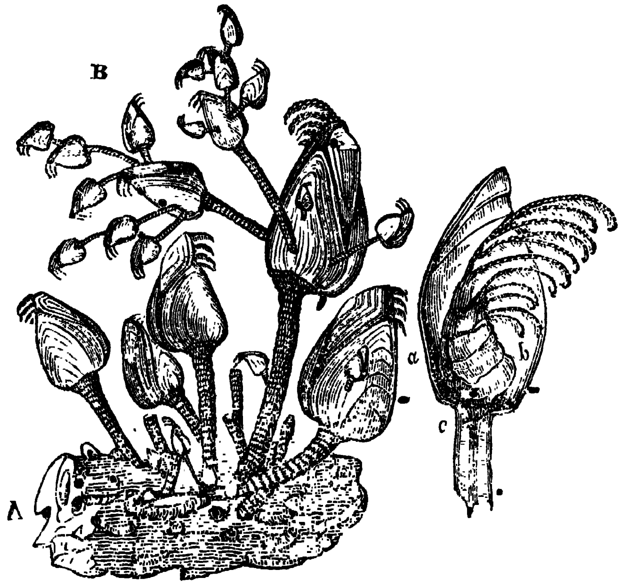
By the Rev. W. B. Clarke, M.A.

JAMES BLAGDEN, Esq., of Poole, brought me, on Feb. 7, 1834, a slice of wood, of about 6 in. by 5 in., with a species of Lepas (*see the cut*) attached to it; in such numbers, that they have defied calculation. The largest is not more than 3 in. long, including the pedicle, which takes up about two thirds of the length. The smallest are so minute as to be microscopic. It appears that the people of one of the Poole pilot-boats found

* Chemnitz, Conchilien Cabinet, xi. 256, lib. 205, f. 2828.

† Preserved in manuscript, and indicated under this name in many collections.

‡ It was found by Mr. Stark, two years ago in the Union Canal, near Edinburgh, and also by English collectors in some of the Docks at London. The British animal is conjectured to have been imported from abroad.—Jameson's Journal, No. 37.



Lepas anatifera.
A, A portion of the wood much perforated by the Teredo.
B, The Lepas, with young individuals growing upon the older.
C, The animal exposed by the removal of the upper lower valve; a, The under lower valve; b, The body of lobes, that of each supporting a pair of ciliated tentacula or feet; c, The double interior tubes.

two, of what they denominated "posts," floating off St. Adhelm's Head, in the morning of Feb. 7, 1834, just subsequent to the late tremendous west and south-west gales; and, perceiving them covered all over with barnacles, they towed them into Poole harbour; from which they were taken ashore at the Hamworthey quay, and there laid aside. Mr. Blagden seeing them, and being struck with the singularity of their appearance, stripped off two or three slices of the wood; which, being very soft, and almost pulpy, was not difficult to remove, and gave me an opportunity of examining them here: I immediately put them into a basin of salt water; and was pleased to see, that, though many of them had been crushed, their native element almost immediately revived them; and not ten minutes after their immersion, the languid and reclining pedicles became erect, and the tentacula were seen protruding from the shell, even in the minutest individuals. So sensitive were several of the larger ones, that, on the approach of a candle suddenly, they instantly withdrew the tentacula, as if the light had offended them. This I consider a curious fact; as it is certain that they have no eyes,

and live much in the dark, attached to the bottoms of ships, and to piles, far under the surface of the water.

On examination, I found that the portion of wood, to which these myriads were attached, is the rugged bark of a branch of the spruce fir; and several captains of vessels have pronounced it to come from Newfoundland, being drifted over in the current and gales. They and others conceive it to have been carried southward, towards the gulf stream, into a warmer latitude, where the Lepas adhered to it; and that the wood then set across from the Azores. That this may have been the case, is likely, as well from the state as from the nature of the wood; for it is not only saturated with water, so as to render it near the bark like the pulp of a paper-mill, but, for an inch or two, it is pierced through in holes, of about half the size of the pedicles of the largest barnacles; which holes, however, have been formed by some Teredo, before the Lepas took possession, as the shell of that creature is found in the thicker part of the branches: and, therefore, I conclude the wood has been very long in the water; drifting about, perhaps, for a year or two in the ocean. A naval officer, to whom I have shown them, recognised these creatures as having been seen by him, attached to logs of mahogany adrift in the Bay of Biscay.

The great singularity of these specimens under consideration is that the shells serve as the ground of attachment for fresh pedicles; so that the specimens form a chain, of which the links are alternately pedicles and shells, as may be seen in the cut B: and so numerous are these links, that there are, in some cases, a series of four, and even five, alternations; not occupying altogether, in many of the smaller ones, a space of more than 2 in. Nor are these alternations limited to the larger specimens, but even the most minute exhibit them; as if the age was not required for their production. The tentacula, also, act in pairs, each pair being inserted into a lobe; several of which lobes make up the body of the Lepas: the length of the tentacula being inversely to the size of the lobes and the nearness of them to the stem (C). On opening the shells, the animal looks, at first, something like a shrimp; but that arises from its curved, feathery, round appearance. On squeezing the lobes, two substances are immediately separated: the one of a perfectly milky white, and the other of a *true-burnt sienna* colour: the latter more consistent than the former, and both opaque; the former lining the cavities of the hollow tentacula as well as the lobes, from which it is extricated in *curd-like* particles. It is possible that a very high microscopic power would detect in these substances not merely a thick fluid, but some structure which would show them to be (if not excrement or aliment) endowed with functions necessary to the life and health of the animal; the cut C. shows the animal in the shell, one of the lower-side valves being removed. The colour of the shell inside is blue, like that of

the mussel; and the hollow, marked c, shows the part where the brown fluid was found.*

ZOOLOGICAL SOCIETY.

Notes, selected and abridged from the Proceedings of the Committee of Science and Correspondence.

THE RHINOCEROS IN NEPAL.

Rhinoceros unicornis, Cuv., are both abundant in the forest and hills of the lower region of Nepal, whence in the rainy season they issue into the cultivated parts of the Tarai to feed upon the rice crops.

The Rhinoceros goes with young from seventeen to eighteen months, and produces one at a birth. At birth it measures 3 feet 4 inches in length, and 2 feet in height. An individual born at Katmandoo eight years since, measures now 9 feet 3 inches in length; 4 feet 10 inches in height at the shoulders; the utmost girth of his body is 10 feet 5 inches, the length of the head, 2 feet 4 inches; of the horn, 5 inches: he is evidently far from being adult. It is believed that the animal lives for one hundred years; one, taken mature, was kept at Katmandoo for thirty-five years without exhibiting any symptoms of approaching decline. The young continues to suck for nearly two years. It has when born and for a month afterwards a pink suffusion over the dark colour proper to the mature hide.—*Mr. B. H. Hodgson, Corr. Memb. Z. S, Aug.* 26.

ADDITIONS TO THE MENAGERY.

September 13, 1834.—The Secretary adverted to some animals lately added to the Menagery, and which he regarded as interesting either in a scientific point of view, or on account of their not having been previously contained in the collection. They included the *silky Monkey*, *Midas Rosalia*, Geoff., of which a specimen has recently been presented by T. Manton, Esq; the *Javanese Ichneumon*, *Herpestes Javanicus*, Geoff.; the *African Moufflon*, *Ovis Tragelaphus*, Geoff., presented by Sir Thomas Reade, His Majesty's Consul-General at Tunis: and a remarkably dark-coloured variety of the *European Bear*, *Ursus Arctos*, Linn., presented by R. H. Beaumont, Esq.

Among the *Birds* there have been added a pair of the *pied Pigeon* of New Holland, *Columba armillaris*, Temm.; a pair of the *Capercailzie*, or *Cock of the Woods*, *Tetrao Urogallus*, Linn., obtained from Norway, and presented to the Society by J. H. Pelly, jun., Esq.; a pair of the *Buffonian Touraco*, *Corythaix Buffonii*, Le Vaill.; and a specimen of the *naked-legged Owl* of the Indian Islands, *Ketupa Javanensis*, Less., (*Strix Ketupu*, Horsf.) presented by James Harby, Esq., and stated to have been brought from Manilla.

Among the *Reptiles* there have recently been added an interesting collection of *Tortoises* from China, presented by John Russel Reeves, Esq., of Canton, and including specimens of the *three-banded Box-Tortoise*, *Cistudo trifasciata*, Gray; of *Spengler's Terrapin*, *Geoemyda Spengleri*, Gray, (*Testudo Spengleri*, Walb.); of the *Emys Sinensis*, *Em. Reevesii*, and *Em. Bealii* all lately described by Mr. Gray; and also of the *Platysternon megacephalum*, Gray. A *Crocodile* apparently referrible to the *Crocodilus cataphractus*, Cuv., is also at present living

* Magazine of Natural History, No. 45.

in the Menagerie: its ... plates constitute a series continuous with those of the back, but consist of only four rows instead of five, the number existing in the individual on which the species was originally founded. The specimen is stated to have been brought from Fernando Po.

September 13.—Mr. Ogilby called the attention of the Meeting to a specimen of an *Irish Otter*, which he at the same time presented to the Society in the name of Miss Anna Moody, of the Roe Mills, near Newtown Lemavaddy, by whom it was preserved and mounted. On account of the intensity of its colouring, which approaches nearly to black both on the upper and under surface; of the less extent of the pale colour beneath the throat as compared with the *common Otter, Lutra vulgaris*, Linn., as it exists in England; and of some difference in the size of the ears and in the proportions of other parts; Mr. Ogilby has long considered the *Irish Otter* as constituting a distinct species; and he feels strengthened in this view of the subject by the peculiarity of its habitation and manners. It is, in fact, to a considerable extent a marine animal, being found chiefly along the coast of the county of Antrim, living in hollows and caverns formed by the scattered masses of the basaltic columns of that coast, and constantly betaking itself to the sea when alarmed or hunted. It feeds chiefly on the salmon, and as it is consequently injurious to the fishery, a premium is paid for its destruction; and there are many persons who make a profession of hunting it, earning a livelihood by the reward paid for it and by disposing of its skin. Mr. Ogilby stated his intention of comparing it minutely with the *common Otter* as soon as he should be enabled to do so by the possession of entire subjects, and especially of attending to the comparison of the osteological structures. He added that he proposed to designate it, provisionally, as the *Lutra Roensis*, in honour of the lady by whom it was presented.

GALLAPAGOS TORTOISE.

October 14.—A letter was read, addressed to the Secretary by the Hon. Byron Cary, dated His Majesty's ship Dublin, Sept. 25, 1834, giving some particulars relative to a large specimen of the *Tortoise* from the Gallapagos Island, presented by the writer to the Society. The specimen weighs 187 pounds, and measures in length, over the curve of the dorsal shell 3 feet 8½ inches, and along the ventral shell 2 feet 3½ inches, its girth round the middle being 6 feet 3½ inches. It is consequently much smaller than several specimens of the *Indian Tortoise* from the Seychelles Islands which have at different times been exhibited in the Society's Garden. The lateral compression of the anterior part of the dorsal shell, and the elevation of its front margin, by which the *Gallapagos Tortoise* is distinguished from the *Indian*, are in this specimen strongly marked.

NEW BEE.

October 28.—Living specimens were exhibited of a species of *Bee* from South America, together with portions of its Comb, contained in the fissure of a log of wood. They were presented to the Society by Mr. Bigg, who stated, in a note accompanying the specimens, that they were found about three weeks since on spliting a log of peach-wood from the Brazils for the use of a dye-house, on the premises of Mr.

Applegath, a calico-printer at Crayford in Kent. The wood had been previously lying in the docks, and had been perhaps eighteen months from the Brazils. Mr. Curtis, to whom specimens were submitted for examination, states that they belong to the genus *Trigona*, Jur., and form a very pretty and apparently undescribed species.

LEPISOSTEUS.

October 28.—M. Agassiz exhibited drawings of several species of *Lepisosteus*, together with some of the details of their internal organization; and, at the request of the Chairman, explained his views with regard to their systematic arrangement and structure, as well as to their relations with various genera of fossil fishes, and the coincidence of some parts of their internal anatomy with that of reptiles. He described two new species observed by him in the British Museum, taking his characters principally from the form and sculpture of the scales, the presence or absence of the short rays at the base of the caudal and other fins, and the variations in the form and disposition of the teeth. In reference to their internal structure, he particularly called the attention of the meeting to the large and regular slit by which the swimming-bladder communicates with the *pharynx*; which he regarded as bearing even a closer resemblance to the entrance of the *trachea* of the pulmoniferous *Vertebrata* in general, than the aperture by means of which the lungs communicate with the *pharynx* in the *Perennibranchiate Amphibia*. He conceived, therefore, that the anatomy of these fishes offers a conclusive argument in favour of the theory, long since proposed, that the swimming-bladder of fishes is analogous to the lungs of the other *Vertebrata*. He spoke of the number of the cæcal appendages as greater in *Lepisosteus* than in any other fish which he had dissected; and referring to certain fossil bodies by which geologists have long been puzzled, and which have been regarded as fossil worms, he stated his opinion, from the close resemblance between the two, that they are in reality the cæcal appendages of the fossil fishes, in whose company they are generally found.

THE ANIMAL OF ARGONAUTA.

October 26.—Mr. Gray exhibited young shells of *Argonauta Argo* and *Arg. hians*, with the view of calling the attention of the Society to a new argument in favour of the opinion that the animal, (*Ocythoe*,) found in the shells of this genus is parasitic. This argument is founded on the size of what Mr. Gray has termed the *nucleus* of the shell, viz. that original portion of it which covered the animal within the egg, and which is usually found to differ in surface and appearance from the remainder of the shell formed after its exclusion from the egg. In the specimens exhibited, Mr. Gray described the *nucleus* as blunt, rounded, thin, slightly and irregularly concentrically wrinkled, and destitute of the radiating waves which are common to the adult shells of all the species of this genus. These waves he stated to commence immediately below the thin hemispherical tips, and he therefore entertained no doubt that those tips constituted the *nucleus* of the shell, and covered the embryo of the animal at the period of its exclusion from the egg. Judging from the size of this portion of the shell, which in one of the specimens measured nearly one-third of an inch in diameter, and was consequently many times larger than the largest eggs of the *Ocythoe* found within the *Argonaut* shells, Mr. Gray inferred that it must have been produced by an animal whose

eggs are of much greater magnitude. The *Ocythoe* cannot therefore, he conceived, be the constructor of the shell, and its true artificer still remains to be discovered. Mr. Gray further remarked, with reference to Poli's statement that he had observed the rudiment of a shell on the back of the embryo of *Ocythoe* examined by him, that he has himself uniformly found, in all the eggs of *Mollusca* which he has examined, the shell well developed, even before the developement of the various organs of the embryo. With respect to the argument derived from the want of muscular attachment, he observed that the animal of *Carinaria* (to which he considered it probable that that of *Argonauta* is most nearly related), although firmly attached to the shell while living, separates from it with the greatest ease when preserved in spirits, being from its gelatinous nature very readily dissolved. These circumstances, he conceived, might fairly account for the animal of *Carinaria* having been, until very recently, unknown, and for that of *Argonauta* still remaining undiscovered.

ORNITHORHYNCHUS PARADOXUS.

December 9.—An interesting paper was read entitled "Notes on the Natural History and Habits of the *Ornithorhynchus paradoxus*, Blum.," by Mr. George Bennett, Corr. Memb. Z. S.; in which the author gives a detailed account of his inquiries and researches on the subject in question, made in the Colony of New South Wales, and in the interior of New Holland, at the end of 1832 and commencement of 1833. He commences by a description of the external character of the animal, as observed by him in the living and recent state; from which it appears that the greater or less degree of nakedness of the under surface of the tail is dependent on age, and is probably a result of the mode in which that organ trails upon the ground; that the colour of the upper mandible above, in an animal recently taken out of the water, is of a dull dirty, greyish black covered with innumerable minute dots, and the under surface of the lower white, in the younger specimens, and mottled in the more aged, while the inner surface of both is of a pale pink or flesh colour; that the eyes are brilliant, and light brown; and that the external orifices of the ears, which are with difficulty detected in dead specimens, are easily discoverable in the living, the animal exercising the faculty of opening and closing them at will. When recent, and especially when wet, the *Ornithorhynchus* has a peculiar fishy smell, proceeding probably from an oily secretion. It is used as food by the natives, by whom it is called, at Bathurst and Goulburn Plains, and in the Yas, Murrumbidgee and Tumat countries, by the names of *Mallangong* or *Tambreet*. Mr. G. Bennett is inclined to regard the two species usually described in modern books as not differing sufficiently from each other to justify their separation, and he therefore retains the name of *Orn. paradoxus* given to the animal by Professor Blumenbach, the universal adoption of which renders it inexpedient in this instance to recur to the older name of *Platypus* imposed on it by Shaw. He remarks on the distortions to which the exceedingly loose integuments are liable in the hands of stuffers unacquainted with the characteristic features of the animal, and gives the general result of his measurements, in the recent state, of fifteen specimens shot and captured alive, as averaging in the males from 1 foot 7 to 1 foot 8 inches, and in the females from 1 foot 6 to 1 foot 7 inches, in total length. One male specimen, shot near the Murrumbidgee River, measured 1 foot $11\frac{1}{4}$ inches; and a female, shot in the afternoon of the same day in the same part of the river, measured only 1 foot 4 inches. In

these specimens the relative proportions of the beak and tail were subject to considerable variation.

Mr. G. Bennett's observations were commenced on the 4th of October, 1832, at Mundoona in the Murray County, on a part of the Yas River, running through the estate of Mr. James Rose. The *Water-Moles* (as these animals are called by the Colonists) chiefly frequent the open and tranquil parts of the stream, covered with aquatic plants, where the steep and shaded banks afforded excellent situations for the excavation of their burrows. Such expanses of water are by the Colonists called "ponds." The animals may be readily recognised by their dark bodies just seen level with the surface, above which the head is slightly raised, and by the circles made in the water around them by their paddling action. On the slightest alarm they instantly disappear; and indeed they seldom remain longer on the surface than one or two minutes, but dive head foremost with an audible splash, reappearing, if not alarmed, a short distance from the spot at which they dived. Their action is so rapid, and their sense of danger so lively, that the mere act of levelling the gun is sufficient to cause their instant disappearance; and it is consequently only by watching them when diving, and levelling the piece in a direction towards the spot at which they seem likely to reappear, that a fair shot at them can be obtained. A near shot is absolutely requisite; and when wounded they usually sink immediately, but quickly reappear on the surface.

A male specimen was shot, and brought out by the dog, on the following morning. In a few minutes it revived, and ran along the ground, instinctively endeavouring to regain the water, but did not survive more than twenty-five minutes. On this individual Mr. G. Bennett made various experiments, with the view of ascertaining the truth of the reports so extensively circulated, of the injurious effects resulting from wounds inflicted by the spur. In no way, however, could he induce the animal to make use of its spurs as weapons of offence; although in its struggles to escape, his hands were slightly scratched by the hind claws, and even, in consequence of the position in which he held it, by the spur also. The result of several subsequent repetitions of the experiment with animals not in a wounded state was the same. The natives, too, never seem fearful of handling the male *Orhithorhynchus* alive.

On the evening of the same day a female was shot, which died almost immediately on being taken out of the water. In this specimen the mammary glands were scarcely observable on dissection; but the left *uterus* was found to contain three loose *ova* of the size of swan-shot. The right *uterus* was less enlarged, exhibited less vascularity, and contained no *ova*.

On the morning of the 7th of October, Mr. G. Bennett proceeded, in company with a native, to the banks of the river to see the burrow of an *Ornithorhynchus*, from which the natives had taken the young during the previous summer. The burrow was situated on a steep part of the bank; and its entrance concealed among the long grass and other plants, was distant rather more than a foot from the water's edge. Its whole extent was not laid open, the natives contenting themselves with digging down upon it at stated distances, their operations being guided by the introduction into the burrow of a stick which indicated its direction. It took a serpentine course, and measured about twenty feet in length: the termination was broader than any other part, nearly oval in form, and strewed with dry river-weeds, &c. From this nest the native stated that he had taken in the previous season (December) three young ones,

about six or eight inches in length, and covered with hair. In addition to the entrance above spoken of, the burrows have usually a second below the surface of the water, communicating with the interior just within the upper aperture. A female specimen, shot in the evening of the same day, was found to have two *ova*, about the size of, or rather smaller, than buck-shot, in the left *uterus*; and in this, as in all the other female specimens, much difficulty was experienced in finding the mammary glands. The contents of the cheek-pouches and stomachs always consisted of river insects, very small shell-fish, &c., comminuted and mingled with mud or gravel, which latter, Mr. G. Bennett suggests, may be required to aid digestion. River-weeds were never observed to form part of the food; but Mr. George Mac Leay informed the author that in a situation in which water-insects were very scarce he had shot *Ornithorhynchi* with river-weeds in their pouches.

From another burrow a living female was taken, and placed in a cask, with grass, mud, water, &c.; and in this situation it soon became tranquil, and apparently reconciled to its confinement. Hoping that he had now obtained the means, should his captive prove to have been impregnated, of determining the character of the excluded product, Mr. G. Bennett set out on his return for Sidney, on the 13th of October, carrying the living *Ornithorhynchus* with him in a small box, covered with battens, between which only very narrow intervals were left.

The next morning, tying a long cord to its leg, he roused it and placed it on the bank of the river, in order to indulge it with a bathe; and a similar indulgence was granted to it on the second day of its journey. On these occasions it soon found its way into the water, and travelled up the stream, apparently delighting in those places which abounded most with aquatic weeds. When diving in deep and clear water, its motions were distinctly seen: it sank speedily to the bottom, swam there for a short distance, and then rose again to the surface. It appeared, however, to prefer keeping close to the bank, occasionally thrusting its beak into the mud, from whence it evidently procured food, as on raising the head, after withdrawing the beak, the mandibles were seen in lateral motion, as is usual when the animal masticates. The motions of the mandibles were similar to those of a duck under the same circumstances. After feeding, it would lie sometimes on the grassy bank, and at others partly in and partly out of the water, combing and cleaning its coat with the claws of the hind feet. This process occupied a considerable time, and greatly improved its sleek and glossy appearance. After its second excursion it was replaced in the box, which was not opened again until the following morning, when it was found to have made its escape.

* * * *

Mr. G. Bennett proceeds to describe in detail their habits in a state of captivity. Their various attitudes, when in a state of repose, are strikingly curious, and were illustrated by the exhibition of sketches made from the life. The young were allowed to run about the room: but the old one was so restless, and damaged the walls of the room so much by her attempts at burrowing, that it was found necessary to confine her to the box. During the day she would remain quiet, huddled up with her young ones; but at night she became very restless, and eager to escape. The little ones were as frolicsome as puppies, and apparently as fond of play: and many of their actions were not a little ludicrous. During the day they seemed to prefer a dark corner for repose, and generally resorted to the spot to which they had been accustomed, although they would

change it on a sudden, apparently from mere caprice. They did not appear to like deep water, but enjoyed exceedingly a bathe in shallow water, with a turf of grass placed in one corner of the pan: they seldom remained longer than ten or fifteen minutes in the water at one time. Though apparently nocturnal, or at least preferring the cool and dusky evening to the glare and heat of noon, their movements in this respect were so irregular as to furnish no grounds for a definite conclusion. They slept much, and it frequently happened that one slept while the other was running about, and this occurred at almost all periods of the day. They climbed with great readiness to the summit of a bookcase, placing their backs against the wall and their feet against the bookcase; and thus, by means of their strong cutaneous muscles and of their claws, mounting with much expedition to the top. Their food consisted of bread soaked in water, chopped egg, and meat minced very small; and they did not seem to prefer milk to water. One of the young ones died on the 29th of January, 1833, and the other on the 2nd of February, having been kept alive in captivity for nearly five weeks.

KANGAROOS.

Dec. 9.—A specimen was exhibited of a Kangaroo, recently brought from New Holland, by Capt. Sir W. Edward Parry, R.N., and presented by him to the Society.

Mr. Bennett called the attention of the meeting to it as representing a species not hitherto described, and distinguishable by its paler colour, which is generally of a slaty grey; by the whiteness of its tail throughout the greater part of the length of that organ; by the comparative length of the tail, which is here longer than the body, whereas in the ordinary greater kangaroo, *Macropus major*, Shaw, it is shorter; by the comparative nakedness of the ears; by the great extent of the naked muzzle; and by a broad white stripe along each cheek.

In a note from Sir Edward Parry, which was read, it is stated that the animal in question is known to the natives in the neighbourhood of Port Stephens (lat. 32° S.) by the name of *Wollaroo*. This individual had been in his possession in New South Wales for two years previously to his embarkation for England, and was allowed to range about at perfect liberty. It set out every night after dusk into the bush to feed, returning generally about two o'clock in the morning. In addition to what it obtained on these excursions, it ate meat, bread, vegetables, &c. Occasionally, but rarely, it ventured out in the day time to a considerable distance, in which case it would sometimes be chased back by strange dogs: these, however, it always outstripped by its superior swiftness, until it placed itself under the protection of the dogs of the house. It died, from the effects of an accident, almost immediately after its arrival in England. Detailed Notes of its dissection by Mr. Owen were read.

In the stomach were found two hair-balls of an oval shape, not rounded as they generally are in the *Ruminants*, which are most obnoxious to these formations. One of them was 3, and the other 2 inches in the long diameter. They were entirely composed of the hairs of the animal, matted together and agglutinated by the mucus of the stomach. Mr. Owen remarks on the interest which attaches to this resemblance to the *Ruminating* tribes, to which the *Kangaroos* make so near an approach in the complexity and magnitude of the stomach, and the simplicity of the *cæcum* and *colon*. He states that he has "more than once observed the act of rumination in the *Kangaroos* preserved in the Vivarium of the

Society. It does not take place while they are recumbent, but when they are erect upon the tripod of the hinder legs and tail. The abdominal muscles are in violent action for a few minutes; the head is a little depressed; and then the cud is chewed by a quick rotatory motion of the jaws. This act was more commonly noticed after physic had been given to the animals, which we may suppose to have interrupted the healthy digestive processes: it by no means takes place with the same frequency and regularity as in the true *Ruminants*."

January 13, 1835.—A specimen was exhibited of the *brush-tailed Kangaroo, Macropus penicillatus*, Gray, which had recently been presented to the Society by Captain Sir W. Edward Parry. Mr. Bennett called the attention of the Meeting to its peculiarities, and remarked on the great hairness of the tail, and especially on its want of robustness at the base, as indicating probably the type of a new genus, to be removed from among the *Macropi* on account of the diminished power of an organ which is so exceedingly strong among the typical *Kangaroos* as to execute, during the act of slow progression and while resting the office of a third leg. In connexion with this peculiarity of tail, Mr. Bennett pointed out also a difference in the form of the third, or extreme lateral, incisor, as compared with the corresponding tooth in *Macr. major*, Shaw; *crania* of the two animals being exhibited for that purpose. The third incisor in *Macr. penicillatus* is bilobed, and approaches somewhat to the character of the corresponding tooth in *Macr. Parryi*, Benn.

A note by Sir W. Edward Parry, which accompanied the specimen, was read. The animal appears to be procurable with difficulty, as this individual was "the only one of the kind ever seen by Sir E. Parry. It was shot among rocks near Liverpool Plains, New South Wales. As several of the same kind were seen together on more than one occasion, they appear to be gregarious. They seemed to prefer the neighbourhood of rocky ground, in which they had holes, to which, when hunted, they retreated. The first intimation received of these animals by Mr. Hall was, that monkeys were to be seen in a particular situation: and the manner in which they jumped about, when he first approached a number of them, left the same impression on his mind. They were so wild that he found it impossible, on his first attempt, to obtain a specimen; and one which he had wounded escaped into its hole. Some months afterwards, however, after remaining on the spot a whole night for the purpose, he succeeded in killing one towards daylight, which is the specimen now presented to the Society."

Mr. George Bennett stated that while in New South Wales he had heard of an animal called *Gunar* by the natives, and found about the Beran Plains, which was described to him as in some degree resembling a kangaroo, but differing from it in having a bushy tail, and in the form of the head, which was stated to resemble that of the hare. He suggested the probability that the *gunar* and the brush-tailed kangaroo might be specifically identical.

BIRTH OF MONKEYS.

February 24.—A letter was read from Lady Rolle, addressed to the Secretary, giving an account of the birth of two young monkeys, the produce of a pair of *Ouistitis* (*Jacchus penicillatus*, Geoff.) in her ladyship's possession. The parents were obtained in London during the last summer, and the young were produced on the 1st of January; one

was born dead, but the other still survives, being about six weeks old. It appears likely to live, and is every day put on the table at the dessert, and fed upon sweet cake. Lady Rolle states that the mother takes great care of it, exactly in the manner described by Edwards in his "Gleanings," p. 151, pl. 218; where the animal is figured and described under the name of the *Sanglin*.

It was observed that young of the same species had been born at the Society's Gardens, but not living; and that a female in the collection of the President, the Earl of Derby, at Knowsley, had produced, about the same time as Lady Rolle's, two living and healthy young ones, which are still thriving.

MICROSCOPIC ENTOZOON.

Feb. 24.—A paper was read by Mr. Owen, entitled "Description of a Microscopic *Entozoon* infesting the Muscles of the Human Body." The author observes, that upwards of fifteen different kinds of internal parasites are already known to infest the human body, but none have been found of so minute a size, or existing in such astonishing numbers, as the species here described. The muscles of bodies dissected at St. Bartholomew's Hospital had been more than once noticed by Mr. Wormald, the demonstrator of anatomy at that establishment, to be beset with minute whitish specks; and this appearance having been again remarked in that of an Italian, aged 45, by Mr. Paget, a student of the hospital, who suspected it to be produced by minute *Entozoa*, the suspicion was found to be correct, and Mr. Owen was furnished with portions of the muscles.

COMPARATIVE OSTEOLOGY OF THE ORANG-UTAN AND CHIMPANZEE.

March 10.—Mr. Owen commenced the reading of a paper "On the comparative Osteology of the *Orang* and *Chimpanzee*." He stated that he was indebted to Mr. Walker for the opportunity of examining and describing in detail the skeleton of an adult *Chimpanzee*, obtained by that gentleman a few years since from the west coast of Africa, which had enabled him to compare it with that of the young animal. This comparison evidenced in that species a series of changes in the advance towards maturity, analogous to those which take place in the *Orang* and the *Pongo*, and consequently afforded a strong confirmation of the opinion which regards the latter animal as the adult of the former.

NEW CORAL.

April 28.—Mr. Gray exhibited an interesting specimen of a new genus of Corals, which he had recently received from the coast of Montserrat in the West Indies. The coral in question is formed almost entirely of rather large transparent rough fusiform *spicula*, which are irregularly placed side by side along the stems, and are imbedded in the animal matter: the *spicula* are so abundant as to render the coral very hard, and to give it much of the appearance of a mass of arragonite, of which it has also the form. Its stem is irregularly cylindrical, rather crooked, and slightly tapering: it throws off a rather thinner branch a little below the middle of the main stem; and both the main stem and its branch end in a hemispherical head, the upper surface of which is covered with forty or fifty rather large conical tubercles, each terminating in a small central mouth. These tubercles are formed of *spicula* re-

sembling those of the stem, the points of which arm the *apices* of the cones. The central cones are the largest and most distinct, and the marginal ones are smaller, and more or less confluent. The stem, when broken, exhibits similar *spicula* and a few internal cells, but it has no distinct central axis; the conical tubercles of the head are hollow, and they doubtless inclose and give exit through their central mouths to the *polypes* which form the coral.

This coral appears to be most nearly allied to the genus *Zenia* (of which *Alcyonium floridum* of Esper is the type), and agrees with it in having no distinct axis, and in having the whole surface covered with large *spicula*, and the *polypes* protruded from tubular cells at the end of the branches. It differs, however, from that genus in its *spicula* being much more abundant, and the coral consequently more solid, and by no means spongy; and in being less branched, with the polype-cells forming a hemispherical head, instead of a bunch of small branches. For these reasons Mr. Gray is led to consider it as forming a new genus, which, until the animal is known, he is induced to place next to *Zenia*, with the following characters:

Genus Nidalia.

Corallium fixum, cylindricum, subramosum, subsolidum, spiculis calcareis dense indutum; apice capitato, hemisphærico, e papillis conicis inæqualibus spiculiferis formato.

Nidalia Occidentalis. *Nid. corallio albido, subramoso.*

Hab. in littore Oceani Atlantici apud Montserrat in India Occidentali.

The specimen described is now in the collection of the British Museum.

APTERYX AUSTRALIS.

May 12.—A letter was read, addressed to the Secretary, by A. M'Leay, Esq., dated Sydney, October 25, 1834. It stated that the writer had, in consequence of the application made to him, set on foot inquiries respecting that interesting bird of New Zealand, the *Apteryx Australis*, Shaw; and that he had succeeded in obtaining a skin of it, (destitute, however, of the legs,) which he had forwarded to the Society. The specimen was exhibited. The skin presented by Mr. M'Leay to the Society was obtained by him from the Rev. W. Yate, who writes to him as follows, dated Waimate, March 10, 1834: "About six weeks ago I had one of these birds in my possession, the second I have seen in the land. I kept it nearly a fortnight, and in my absence it died. One of my boys took off the skin; the legs rotted off. I have very great pleasure in sending you the skin as it is. Should I ever meet with another, I will do all I can to preserve it for you. Its food is long earthworms. It strikes with its bill on the ground, and seems to know by the sound where its prey lies. It then thrusts its bill into the ground, draws up the worm, and swallows it whole and alive. They kick very hard, and their legs are remarkably strong for the size of the bird. They are very rare in New Zealand, but are found in the greatest numbers at Hiku Rangi, the mountain which you mention."

BOTANY.

PLANTS PRODUCING SILICA.

Dr. Daubeny has devoted a paper in the *Linnæan Transactions*, vol. xxii., p. 2, to an account of some researches carried on in prosecution of the curious facts pointed out by Schrader and others, who found that there was some reason to conclude that plants, in their assimilating processes, produced silica.

Their method of proceeding was first to burn the seeds and ascertain the quantity and nature of the residual earthy matter; then to sow a given portion of similar seeds in sulphur: and then to ascertain the nature of the earths contained in the ashes of the plant. Dr. Daubeny employed different soils, and instituted a comparison between the effects of each. The materials of the soils were sulphate of strontian, Carara marble, sea sand. and mould. The results do not appear to lead to any new inference. The author, however, concludes "that the roots of plants do, to a certain extent at least, possess a power of selection, and that the earthy constituents which form the basis of their solid parts, are determined as to quality by some primary law of nature, although their amount may depend upon the more or less abundant supply of the principles presented to them from without."*

SPONTANEOUS PLANTS.

Few things are more extraordinary than the unusual appearance and developement of certain plants in certain circumstances. Thus, after the great fire of London in 1666, the entire surface of the destroyed city was covered with such a vast profusion of a species of a cruciferous plant, the *Sisymbrium irio* of Linnæus, that it was calculated that the whole of the rest of Europe could not contain so many plants of it. It is also known that if a spring of salt water makes its appearance in a spot, even a great distance from the sea, the neighbourhood is soon covered with plants peculiar to a maritime locality, which plants, previous to this occurrence, were entire strangers to the country. Again, when a lake happens to dry up, the surface is immediately usurped by a vegetation which is entirely peculiar, and quite different from that which flourished on its former banks. When certain marshes of Zealand were drained, the *Carex cyperoides*

* Thomson's Records, No. 10.

was observed in abundance, and it is known this is not at all a Danish plant, but peculiar to the north of Germany.—In a work upon the useful Mosses by M. de Brebisson, which has been announced for some time, this botanist states that a pond in the neighbourhood of Falain having been rendered dry during many weeks in the height of summer, the mud, in drying, was immediately and entirely covered, to the extent of many square yards, by a minute, compact, green turf, formed of an imperceptible moss, the *Phascum axillare*, the stalks of which were so close to each other, that upon a square inch of this new soil, might be counted more than five thousand individuals of this minute plant, which had never previously been observed in the country.*

ON THE EXCREMENTITIOUS MATTER THROWN OFF BY PLANTS.

By J. Buel.

I HAVE read, with much interest, the opinions lately advanced by De Candolle, Macaire, and, I believe, by Professor Lindley, in regard to the excretory powers of plants. I fully asquiesce in the statement that plants throw off, into the soil, excrementitious matters, not congenial to their wants; but I cannot accede to the other part of their theory, viz.—that these matters are poisonous to the species which gives them off, and that from this cause arises the necessity of an alternation in farm crops. I will briefly state my reasons for this dissent, and shall be happy to be corrected by any of your correspondents, if I am in the wrong.

I venture to assert, in the first place, that in forests and uncultivated grounds, the same plants, annuals as well as perrenials, are found growing in successive years, without apparent deterioration, if the plants are permitted to remain and decay where they grow. It is not what grows upon the ground, but the crop which is carried off, that impoverishes the soil. We find an additional illustration of this truth, upon waste ground around farm buildings, where we often see the bur dock, nettle, hemp, and other plants, grow up, fall, and decay, for years; and each successive growth increases, rather than diminishes, in vigour.

American husbandry furnishes facts no less apposite to my arguments. In a large section of Western New York, comprising a district of sixty, or more, miles square, it is a very common practice to grow wheat in the same field for successive years. On a recent visit to that district, I put the question to an intelligent circle of gentlemen, "how many years in succession has wheat been grown upon any of your lands?" One case was cited where it had been grown twenty-one or twenty-two years. A gentleman then alluded to a neighbour, who had grown wheat

* Jameson's Journal, No. 39.

twenty-two years without intermission, on one field, and the fact was accredited and confirmed by others. "And what," I asked, "was the product of the last season?"—"Forty bushels to the acre," was the answer.—"Was manure applied?"—"No."

In another district of the state, comprising the south towns of Erie and Chautauque counties, oats constitute a favourite crop; and they are grown many successive years on the same ground, without diminution of product.

In some districts of Ohio, Indian corn has been planted on the same ground, almost from the first settlement of the country. A respectable gentleman who resides on the banks of the Sciota, at Portsmouth, writes as follows: "My farm is immediately at the mouth of the Sciota river. It is rich bottom land. The soil is loam, finely proportioned, with clay and sand, formed by successive depositions from the Ohio and Sciota rivers, which inundate it every year. I do not think there is much difference in the quality of the soil for the depth of fifteen or twenty feet. Many fields have been cultivated in corn for twenty or thirty years in succession, and I doubt whether a cart load of manure was ever used in the place before I became in possession of it."

The preceding facts, and similar ones, which might be stated, amply disprove in my mind, the theory attempted to be established, that the excrementitious matter of plants is poisonous. The necessity, in good husbandry, of altering farm crops, arises, I think, from the facts, generally conceded, that plants do not take up, or retain the same food; that each species takes something specific which others do not take; and that in ordinary soils there is not enough of this specific food to maintain successive crops without deterioration. The cases which I have cited refer not to ordinary, but to extraordinary soils, which form exceptions to a general rule. These are so abundant in the specific food of the wheat, the oats, and the corn, that years of successive cropping have not exhausted, nor sensibly impaired the supply.*

DIRECTIONS FOR PRODUCING SKELETONS OF THE LEAVES, CALYXES, AND SEED-VESSELS, OR OTHER PARTS, OF PLANTS.

By G. Francis, Esq.

PROCURE an open-topped earthen pan, holding a gallon or more, and put into it a *quantity* of leaves, seed-vessels, &c., selected according to the subsequent directions; and pour upon them a sufficiency of *boiling* soft water to cover them. This done, place the pan upon the tiles of the roof of the house, or in any other place exposed to the warmth of a summer's sun and the vicissitudes of the weather. Stir the leaves occasionally (say, once or twice a week) and carefully, but never change the water.

* Silliman's American Journal of Science and Arts, July, 1835.

The putrefactive fermentation will now soon ensue; and, in about six weeks or two months, according to the nature of the subjects, many of the specimens will be completely macerated; and will require no other attention than holding them singly under the tap of the water-tub, or some other small forcing stream of water, which will wash away all the other skin and green fleshy matter. If this matter does not come off readily when assisted a little with the thumb and finger, or a small knife, the leaves must be soaked for a longer time. Those of the leaves which seem liable to break during the washing of them may be preserved from breaking by placing them upon a little piece of board, and holding them by the thumb and finger; and, should a little of the green fleshy matter remain fixed between the interstices of the skeleton leaf, it may easily be removed by striking the leaf *perpendicularly* with a clothes brush.

They will now only require bleaching. This may be done, very effectually, by placing them in a bandbox, with a little sulphur burning in a small vessel beside or under them. The most sure way, however, of bleaching objects of this nature is, to immerse them, for a few minutes, in dilute chloride of lime, or chloride of soda.

The reason of the process of macerating directed will be readily understood by the chemist, who knows that the degree of success in the preparation of all anatomical subjects depends entirely upon the degree of putrefactive fermentation which takes place. Everything, then, which increases this fermentation hastens the object: it will instantly be seen, therefore, why the proper time is during the summer months; and this is, also, the only time when specimens can be procured. It will be evident, also, why the water must not be changed; and why a quantity must be done at once. The object in putting boiling water, in the first instance, is, to destroy vitality, and to soften, in some degree, the texture of the outer coating. Metallic vessels, especially iron ones, are very unfit to immerse any anatomical preparations in, as they communicate to the objects the dark brown stain of oxide of iron, which nothing afterwards will remove.

Choice of Subjects.—Such are to be chosen as are of a fibrous woody texture; and these are to be gathered at that time of the year when the internal woody fibre is sufficiently hard (as about June or July): though, in the case of leaves, those of ivy and holly may be taken all the year; and seed-vessels may be taken a little before the seed is ripe. In making your selection, carefully avoid all which are of a resinous nature, as attention to these will be but thrown away: thus the leaves of the fir tribe, the camphor tree, the laurel, the bay, and of most of the evergreen shrubs and trees, are inapplicable. This advice will apply, with still stronger force, to the astringent kinds: it is in vain to try the leaves of the oak, chestnut, maple, elm, willow, horn

beam, sycamore, tea, buckthorn, walnut, hazel, and many others; as the leaves of all these contain much tannin, which not only renders them imperishable, but, by contaminating the water, prevents the decomposition of the other leaves under maceration with them.

I have found the following proper and easy Subjects:—Leaves of the white poplar, black poplar, Lombardy poplar, apricot, apple, orange, lemon, box, ivy, holly, many of the exotic passion flowers; Magnolia glauca, acuminata, and others; lime tree, tulip tree. Calyxes of Moluccella lævis, which are, when prepared, very beautiful; also the calyxes and seed-vessels of Nicandra physaloides, of the winter cherry (Physalis *Alkekengi*), of henbane (Hyoscyamus niger); of all the campanulas, particularly Campanula Medium (Canterbury bell), C. rotundifolia (the harebell), and C. Trachelium: the larger mallows, the tree mallow (Lavatera arborea), horehound (Marrubium album); Eryngium Andersoni, alpinum, campestre, and maritimum; Medicago falcata and arborea; Stachys sylvatica, several of the nettles, Galeopsis Ladanum, Dictamnus albus, Phlomis fruticosa, *Datura* Stramonium, Atropa, the scutellarias, and the capsules of all the species of poppy. To these may be added the stalks of cabbage, radish, flax, hemp, and stinging nettles; the tuber of the turnip; the involucres of Astrantia major and austriaca, and of the Hydrangea Hortensia.

Should not the above be sufficiently explicit, I shall be very happy to remove any difficulties, either publicly or privately; and be gratified to show to any correspondent or reader my collection of prepared specimens, which are numerous.

It is right to observe, that I have seen many other leaves, &c., of some of the thistles and of resinous plants, well dissected: but with these I have not succeeded; nor have I by the process of boiling them in dilute acid, though I have understood that, by this process, they may be done in a few minutes.*

MANNA.

On Feb. 27th, Dr. Kidd read to the Ashmolean Society of Oxford, a paper on a species of manna produced in the neighbourhood of Mount Sinai.

It is a gum which exudes from a species of tamarisk, through minute punctures in the bark made by insects. It drops upon the ground in a liquid state, but congeals by the cold of the night. It is eaten by the natives, and has a sweet taste.

Though denominated by Niebuhr, "manna Israelitarum," the author argues that it must not be confounded with the manna mentioned in Scripture, since the quantity produced at the present day would be utterly inadequate to the supply of so numerous an assembly.

* Magazine of Natural History, No. 48.

The paper was illustrated by a large coloured drawing.

Mr. Plumptre stated, that a deposition of manna had been observed by Mr. Gray, in the same part of Arabia, at a distance from any trees, apparently condensed, or precipitated from the atmosphere, and appearing deposited on objects like hoar frost.*

NATIVE COUNTRY OF MAIZE.

ROULIN, Humboldt, and Bonpland, have noticed this plant in its native state, in America, and have hence concluded that it was originally derived from that country. Michaud, Daru, Gregory, and Bonafous state, that it was known in Asia Minor before the discovery of America. Crawford in his History of the Indian Archipelago, tells us that maize was cultivated by the inhabitants of these islands, under the name of *djagoung*, before the discovery of America. In the Natural History of China, composed by Li-Chi Tchin, towards the middle of the sixteenth century, an exact figure is given of maize, under the title of *la-chou-cha;* and Rifaud, in his "Voyage en Egypte, &c., from 1805 to 1807," discovered this grain in a subterraneous excavation in a state of a remarkably good preservation. M. Virey, however, refutes these statements, (*Journal de Pharmacie*, xx. 571,) by showing that these authors have mistaken the *holcus sorghum* for maize, and that the maize of Rifaud is the *holcus bicolor*, a native of Egypt according to Delile. Where maize occurs in the east there is no proof of its having been carried there previously to the discovery of America.

Maize, (Zea mays) therefore sprung from America; *millet*, or *couz couz* from Africa; *rice*, (*oryza sativa*,) from Asia; and wheat, barley, and oats, from Europe.†

DISEASES OF THE LARCH.

ACCORDING to Mr. Stephens of Edinburgh, who has addressed a letter to De Candolle upon the subject, the larch, (*Larix Europæa*), is subject, in Great Britain to two diseases. The first disease consits in the decay of the heart of the wood. It occurs not only in wet situations, but also in dry places, as in Nottinghamshire, where immense losses have been sustained. It has only manifested a slight appearance at Dunkeld, and is most prevalent in England. The larch has been found not to thrive, where Scotch fir (*Pinus Sylvestris*) has previously existed; but this is not the cause of the disease. Another disease to which it is subject, is a blister, which forms about 2 feet above the ground. These blisters are produced on two sides of the tree alternately, until they reach the top, when the tree dies from above downwards as it were. Sometimes the blister surrounds a branch, which breaks off in the course of time. This accident is fre-

* Thomson's Records, No. 6. † Thomson's Records, No. 7.

quently ascribed to the weight of snow. The range of this disease is at present bounded by the county of Forfar, and the south of the Grampians. It attacks entire plantations, but rarely trees above 25 years of age, and is most destructive in poor soils, or on hard formations, as clinkstone.

None of the Dunkeld trees, at an elevation of 1000 feet have been affected.

De Candolle states, that on the Alps, the larch is free from any disease, save the occasional loss of its leaves by the attacks of a caterpillar, and a resinous blister or cancer, which however, produces no injurious effect upon the tree. It grows extremely well at Moritzburg, near Dresden, in a moist sandy soil, 238 feet above the sea. He proposes for this country the following recommendations:

1. That the higher parts of the country are best suited for its growth, provided that the ground be not too dry, nor hard, nor marshy.

2. That the sides of the hills are better suited for it than the summits, and if the summits are marshy, the inferior parts of the mountains will be proper for it.

3. It is remarked on the Alps, that the larch succeeds better in a northern than in a southern exposure. The difference is sometimes so striking, that in valleys running from east to west, it is not uncommon to see the side exposed to the north covered with larches, and that exposed to the south, with scarce a tree. This may be ascribed to the irregularity of the spring, but will not apply to this country.

4. The plantations of larch in this country are too thick, the trees being generally planted at a distance of 3 or 4 feet. De Candolle considers that the young trees ought to be planted at a distance of 10 feet, and if planted closer, they should be gradually thinned for 20 years.

He recommends likewise, that for security, new seed should be brought from the Valais, where the cones are died by the heat of the sun, and not from the Tyrol, where fire is employed for this purpose.

M. Em Thomas sells them at the rate of 2½ frances (2*s.* 1*d.*) the half Kilogramme (1⅓ lb. troy). M. Thomas advises that the trees should be always transplanted in autumn and not in spring.*

NEW METHOD OF DRYING PLANTS.

Dr. Hunefeld recommends a new method of drying plants, by covering them first with the powder of lycopodium, and then placing them in a vessel containing chloride of calcium. By this method the colour and flexibility are preserved. On the 29th of July, 1831, the thermometer being at 53½° Dr. Goppert of Breslaw, placed in a 24 ounce glass two leaves of the hyacinth, and a specimen of the *Fumaria officinalis*, with two ounces of muriate of lime, in such a manner that the plants were not in

* Thomson's Records, No. 7.

contact with the salt. On the following day the leaves began to dry, and on the 3rd of August, although not dead, the hyacinth leaves were capable of being reduced to a fine powder. Even fleshy plants as the *Sedum rupestre* are so much dried in seven days, that they may be pulverized. The use of the lycopodium powder is to prevent the sap from escaping.—*Brande's Pharm. Zeit.* 5. 1835, 71).*

ON THE SEED-DISPERSING APPARATUS OF THE MUSK-SCENTED HERON'S BILL (ERODIUM MOSCHATUM W.)

By Robert Mallet, Esq.

HAVING some plants of the Erodium moschatum in cultivation, I have been struck with admiration in observing the arragements for the dispersion of the seeds; and, having looked into many books, and not found any particular notice of this, I am induced to send a description of it, for the benefit of those who admire the innumerable and beautiful contrivances of the Almighty Architect.

Each seed (of which there are five to each flower) is inclosed in a capsule [carpel], attached by its upper extremity to a tail, or awn, which possesses the most wonderful hygrometric sensibility; as, indeed, does every other part of the plant. These five awns lie in grooves in the recepticle of the flower [and this receptacle is central to, and is the axis of, all parts of the flower and fruit] (as in pelargoniums, geraniums, &c.) When the whole system has arrived at a certain point of *aridity*, the awns, which are provided with an exquisite power of torsion, twist themselves out from their grooves and, at the same moment, a number of downy filaments, hidden at the back, or inward face, of the awns, bristle forth: they all together become, now, detached, and fall to the ground.

But here they still continue to twist; and, from the position in which they always lie, keep tumbling over and over, *and thus receding from the parent plant*, until they have twisted themselves into the form of perfect balloons, ready to be wafted away by every zephyr. But motive power has not ceased to the apparatus attached to the seeds when this has twisted itself into this ballon shape; the slightest hygrometric change produces motion, either backwards or forwards, in the awn: and the constant tendency of this motion is to *screw the seed into the ground.* Such is the shape and great sensibility of the awns, that they may be readily applied to form most delicate differential hygrometers, for which purpose I have used them.

The arrangement of the seeds of the Pelargonium peltatum is almost identical with the above, but less marked.

The extreme beauty of the contrivance, thus attempted to be described, can hardly be appreciated without examination of the

* Thomson's Records, No. 7.

plant itself: for which object, as well as for its appearance as a border plant [and the high musky odour of its herbage], it is worthy of cultivation.

It seems to me that no part of the organization of plants is so well worthy of attentive examination as the contrivances for effecting the dispersion of the seeds: these in all cases show the benevolent provisions of the Creator, that vegetable food may be spread abroad, and increase, and that the earth may be full. Each solitary contrivance of dispersion strikes the mind as above human invention, and as defying human imitation; but when we wander from one to another, and see their almost infinite variety, admiration of individual contrivance is lost in the plenitude, the apparent wantonness of immeasurable design, every where different, and every where perfect.*

BOG TIMBER.

On the 11th of August, Mr. J. T. Mackay, of the College Botanic Garden, Dublin, read to the British Association, a short communication from Archdecon Vignoles, relative to bog timber, from the county of Westmeath, accompanied by specimens from a bog eighteen feet deep. It is remarked in the communication, that there are in several of the bogs three layers of trees, with a stratum of peat between each layer, from three to five feet in depth; that as the trees in the different layers had arrived at maturity, they could not have been coexistent; that in most cases the timber bears marks of fire; and that the roots are rarely attached to the trees. Mr. Mackay remarked, that these specimens of bog wood appeared to belong to the *Pinus sylvestris*, but that it is supposed that the *Pinus pinaster* was formerly very abundant in the south of Ireland. Many of the woods are useful in building, and for domestic purposes; and the fir, when split up, is used for candles. Reference was made to the work of Colonel Colby on the subject. Colonel Sykes remarked, that he had observed similar arrangements in the bogs of Scotland; that they contained three distinct layers of trees, the first layer a foot from the surface, quite fresh; then a layer of peat; next a layer of wood, slightly carbonized; under that a layer more carbonized, and slightly bituminized.†

ANCIENT YEW-TREES.

At the last meeting of the British Association, Mr. Charles W. Hamilton, of the Horticultural Society of Ireland, gave Mr. Mackay an account of a yew found in a bog in Queen's County, in which he was able to count annual rings indicating a growth of 545 years. Yet so compact was the wood, or so close the

* Magazine of Natural History, No. 57.
† Jameson's Journal, No. 38.

layers, that the diameter of the trunk did not exceed a foot and a half. The growth had been very slow during the last three centuries, for near the exterior there were about 100 rings within the space of one inch. From the size and number of the yews found in Ireland, and the elevated stations they take amongst the rocks when they assume the stunted appearance of the juniper, Mr. Mackay has no doubt of its being a native tree. He exhibited the common and the Florencecourt Yew, a beautiful variety, growing like the cypress. He added, that the seeds of the Irish yew would produce the common tree; but Dr. Graham suggested, that as there might be mules, it would not prove that they were the same species. Mr. Babington stated, that another variety had been discovered, in which the horizontal branches produced only drooping sprays on the under side, and that both sexes of the flowers were detected.

Mr. Saunderson called the attention of the meeting to a curious extract he met with in an old Scotch history. It stated, that the northern part of Ireland was so much infested by yew-trees, that a great emigration of Irish took place in consequence, who, with their families and cattle, went over to settle themselves in Scotland, these yew-trees every year destroying their cattle in Ireland. Dr. Litton said, he had tried the age of the celebrated yew-tree at Muckras by Decandolle's test, and found that it nearly agreed with the traditional one. He also exhibited a specimen of an oak-tree, bearing the impress of letters on the inner concave surface, which corresponded with the observations made at a previous meeting by Dr. West.*

ACTION OF LIGHT ON PLANTS.

By Professor Daubeny.

At the last meeting of the British Association, Professor Daubeny reported the progress which he had made in his experiments on this subject since 1833, when he communicated the results obtained up to that time to the British Association, at Cambridge. At that period he had ascertained that the quantity of carbonic acid decomposed by a plant was in proportion, not to the chemical or heating influence of the ray transmitted to it, but to its illuminating power: he has since found that the functions of exhaling moistures by the leaves, and absorbing it by the roots, depend upon the same law: with this difference, however, that, provided some light be present, a body radiating much heat will serve as a substitute for one transmitting a greater degree of light. Thus, a solution of ammonio-sulphate of copper, which absorbs and consequently radiates much heat, is nearly as efficient in causing the exhalation and absorption of moisture as glass, which transmits the entire spectrum; and in

* Jameson's Journal, No. 38.

proof that this does not depend upon any peculiar power residing in the violet ray, water obscured by ink, so as to produce an equally feeble illuminating effect, was found, in consequence of the heat it radiated, to produce an equal degree of exhalation. Yet when the plant was covered over by opake bodies radiating much heat, the amount of moisture exhaled was very inconsiderable.

Professor Daubeny has employed, in his experiments on plants, the light emitted by balls of lime ignited by the oxy-hydrogen jet, but could not discover that it exerted any influence on the quantity of moisture exhaled by them.*

ON THE FORMATION OF WOOD.

By Dr. West.

At the last meeting of the British Association, Dr. West exhibited a specimen of Bog-Yew, in which, from the non-adherence of two successive annual layers, the central portion of the heart-wood, though in close contact with the surrounding portion, which constituted the greatest part of the bulk of the tree, was throughout its whole extent perfectly distinct from it, so as to present the appearance of a small tree which had grown up through the centre of a large one, adapting itself completely to its cavity. He considered this singular phenomenon to be the result of a severe frost, which had either frozen a very thin layer of alburnum, so as to destroy its vitality, and thus prevent the next-formed layer from adhering to it, or else, without absolutely destroying it, had so affected its exterior surface as to produce the same result. He expressed a doubt whether this exactly answered to the lesion called by the French *gelivure*; and produced a drawing, copied from one by Decandolle, of a section of a juniper tree affected with that lesion, in which the diseased layer was of comparatively considerable thickness, whereas in his specimen there was no appearance whatever of a diseased layer, however thin, nor any space where such could have been. He alluded also to another lesion, mentioned by Duhamel, called *roulure*, which consisted to the non adherence of the annual layers, and so far appeared to have a greater resemblance to the case under consideration; but for want of a more detailed account he did not venture to pronounce whether they were identical. He next entered into the consideration of how far this case, and still more that of Decandolle's juniper tree, might be urged in favour of Duhamel's theory of the formation of wood, and against those of Decandolle and Du Petit Thouars; and remarked that at all events, it clearly proved that the bark can form good wood, independently of the aid of the alburnum. He further adduced the fact, that the nodules of wood that are

* Philosophical Magazine, No. 42.

found on the trunk of the beech have always a layer of liber interposed between them and the alburnum; and expressed his opinion that this afforded an additional proof, that the bark has, in general, if not the sole, at least the predominant influence in the formation of wood. In this specimen, the annual layer formed after the occurrence, whatever it was, that prevented its adhesion to that of the preceding year, was as thick and sound as any of those that were near it, though it must apparently have been formed wholly by the liber.*

GEOLOGY.

GEOLOGY OF IRELAND.

At the late meeting of the British Association, Mr. Griffith presented his Geological Map of Ireland, the result of many year's research and labour; and pointed out the difficulties which at present attended the delineation of the boundaries of the formations consequent on the imperfections of the existing maps. He said he of course excepted the maps published by the Ordnance Survey, than which nothing could be more splendid. The map in the present case adopted is Arrowsmith's, and it had been found necessary to make the geological colouring conform to the geographical innaccuracies it contains. As an example of such imperfections, it was mentioned, that, in Arrowsmith's map, Ben Wee Head, which is due wast of Sligo, is placed twenty miles north of that parallel. A new map of Ireland is about to appear in London, and which, if it shall be found to agree with the trigonometrical survey maps, it is Mr. Griffith's intention to employ. In pointing out the remarkable features of the country, Mr. Griffith dwelt on the position of the mountain groups, which, except when limestone occurs on the coast, form the margin of the island, and inclose a vast plain which is chiefly of limestone. Owing to this arrangement the river courses are short, except that of the Shannon, which is 140 miles long, and falls 80 feet in the first 20 miles, and only 80 the remaining 120 miles. On the great plain of the interior there occur extensive ridges of gravel, called "escars," which are sometimes 100 feet in height, and which though nearly constant in direction when considered in small spaces, are variable when the comparison extends to spaces of greater magnitude. They run for ten, twenty, or even thirty miles, and formerly the roads were frequently constructed on their summits. In the county of Mayo, the gravel hills run east and west, whereas to the north they run north and south. Accoding to Mr. Griffith, the great bogs were formed in hollows, in which the water was dammed up by these gravel hills. Under the bogs very extensive and deep deposits of marl occur underlaid by clay and gravel. The marl is in some instances forty feet in thickness. The colours adopted by Mr. Griffith in the construction of his map are chiefly those used by Mr. Greenough. Confining himself, on this occasion, to the stratified

* Philosophical Magazine, No. 42.

rocks, Mr. Griffith first considered the gneiss and slate districts, and stated his opinion that the primary group of the north-west and west of Ireland corresponds to a similar group in the Grampians of Scotland; while the Down slaty group is probably connected with the rocks of Dumfriesshire, &c. No relation has hitherto been ascertained to exist between the Wicklow series and any group on the opposite side of the Channel. The general direction of the stratification to the north of Ireland is north-east and south-west, but in some parts of Tyrone it is more north and south. In the south the direction approaches more to the east and west. At Dunmorehead, county of Donegal, the quartz-rock exhibits a concretionary structure similar to that of orbicular granite, and is often mistaken for a trap-rock. The limestone beds associated with the schists of Donegal are not continuous, though they occur in certain lines. They are sometimes cut off by trap-dikes, and then become dolomitic. The primary district of Mayo and Galway is similar to that of Derry and Donegal. Mr. Griffith proposes to divide the transition slates of Ireland into groups, as soon as the state of the science enables him to do so. In the newer portion of these deposits occur alternations of sandstone and clay-slate; and again a limestone similar to that of the Blackwater, and containing organic remains, alternates with the upper part of the schist; and, as in this latter case the limestone contains fossils of the mountain limestone, the schist which alternates with it must also be of comparatively recent origin. A section from Dungarvon to Carrick was exhibited, and another in Waterford. The old red sandstone is considered by Mr. Griffith as divisible into two or even three parts, viz, 1st, The common old red; 2nd, A white variety which occupies a central position; and, 3rd, A sandstone which alternates with the oldest part of the coal formation. In the county of Mayo there are beds of the sandstone alternating with limestone. Though there seems to be a transition from the limestone to the sandstone, yet there are always portions of the formations where in the one all the strata are of limestone, and in the other of sandstone. The mountain limestone, formation extends from the county of Cork to Fermanagh, and occupies two-thirds of Ireland. A section from Newcastle in county Down to Benbulbin in Sligo, was exhibited. A singular cavern occurs in the limestone under the mountain of Kulkeagh. It contains no stalactites or stalagmites, but its sides have a remarkably smooth and polished surface. Mr. Griffith regards the calp of Kirwan as the lowest bed of the mountain limestone, but as a member of the series which ought to be distinguished from the series of Benbulbin. The calp rarely if ever contains fossils. Mr. Griffith next described the various coal-fields of Ireland, beginning with those of the south, and particularly that of Cork. There the coal strata consist of *stone-coal*, shale, clay-ironstone, fire-clay, a quartzose rock which can hardly be termed sandstone. The dip is to the south, and the limestone at the edge of the coal-field dips to north, but the exact point of junction at Blackwater is not visible. The coal strata have an undulating character. A section of parts of the counties of Cork and Limerick was exhibited. The coal formations of the north contain *bituminous coal*. That of the county of Monaghan rests on graywacke, and its lower beds are chiefly sandstone; and that of southern Tyrone and Fermanagh contains thin seams of coal. The coal-fields of northern Tyrone, which is richer, and has been described in a separate report by Mr. Griffith, consists of two parts, an outer of limestone, sandstone, and shale, and a little coal; and

an inner, containing a greater portion of coal, which is of a soft description. There is another coal-field in the north-west of Fermanagh, and there is also the singular and disturbed coal district of Antrim. The formations newer than the coal strata occurring in Ireland, are confined to the north-east part of the island, and consist of new red sandstone, a magnesian limestone, lias, greensand, and chalk. The new red sandstone occurs on both sides of the trap district of Derry and Antrim, viz. to the west, beginning at Caledon, and extending due north to Macgilligan, county of Derry, whence it may be traced round to Donegal; and to the east of the trap district it extends past Belfast. On the south side of Belfast loch there is a deposit of magnesian limestone, the only one in Ireland. In some places the new red sandstone abounds in gypsum. The lias occurs at Larne, in the county of Antrim. Some details were given respecting the greensand and the chalk.

Mr. Griffith concluded his observations by describing the nature, distribution, and mode of occurrence of the various unstratified rocks which are met with in Ireland. He spoke first of the granite districts. The granite district of Dublin and Wicklow is fifty miles from north to south, and eleven in breadth. The district of the Morne Mountains in Down, is characterized by the rocks containing much hornblende, whereas there is none in the Wicklow rocks. A transition may be observed from granite to sienite. The district of Down contains no mica slate, and is in this respect different from Wicklow. Beryls and topazes occur in Down, and beryls have also been found in Wicklow. The strata of Down run N. E. and S. W., and this direction is not altered by the granite. On the S. and S. W. sides the strata are somewhat distorted, but on all sides the rocks are materially altered at their contact with the granite. The characters of the slates are changed, and the greywacke is converted into a quartz rock. Veins proceed from the granite into the slate, and produce alteration of characters. The district of Antrim consists of mica slate containing granite, which is often porphyritic, and may sometimes be termed porphyry. The masses of granite sometimes resemble beds in the mica slate. Mr. Griffith entered into a variety of details regarding the sienites, traps, and porphyries of the north and other parts of Ireland. He seemed to consider that the phaenomena he had observed prove that the sienite of the north of Ireland is of posterior origin to the chalk and the porphyry. The granite of Galway and the porphyry of Lowth were described, and some instances given of the conversion of limestone into dolomite at its junction with trap. In Donegal, a point was mentioned where a columnar quartz rock lies between two portions of non-columnar trap. The ochre beds in the island of Magee, &c. and their relation to the porphyries, were then discussed. Many interesting views were exhibited of the coast of the northern trap district. The trap-dykes and horizontal beds of trap were noticed, and their general direction given as follows;—those of Mayo E. and W., of Fermanagh N. of W., of Down S. of E. and N., of Antrim N. and S. A geologically coloured copy of the mining index map of the county of Down was exhibited.*

FOSSIL ICHTHYOLOGY.

M. Agassiz, in placing before the British Association, the fifth part of his researches on fossil fishes, and also 112 plates of English ichthyolites newly figured, and which will appear in the succeeding numbers of his

* Jameson's Journal, No. 38.

work, made some observations on the general results he had obtained from the inspection of the greater part of the collections of Great Britain. One circumstance, which is certainly remarkable, and which gives great consistence to these researches, is, that the discovery of nearly 400 new species of fossil fishes, has in no degree modified the conclusions which the author had deduced from the examination of 500 species, with which he was acquainted, when he commenced the publication of his work. The most important of these results for the geologist is, that very intimate relations in organization exist among fishes of the same epoch, and that progressive changes may be remarked in the fossils of different formations; so that it appears to the author possible to determine the relative age of a deposit, even by the examination of unknown species, and solely by the peculiarities of their organization. M. Agassiz then offered some remarks on the mode of deposition of the beds which contain the fossils, and on the difficulty of reconciling the mineralogical phenomena of stratification, and the conditions of existence in which the fossils contained in these beds must necessarily have been placed. It appears to him probable, that all the fossils contained in a formation have lived together, and perished in consequence of one catastrophe; that the organic remains which have been preserved in these beds, are rarely the debris of animals which have successively perished during epochs of comparative repose, but rather the remains of those which have been suddenly buried, in consequence of revolutions which produced great changes in the *ensemble* of organic beings. It seems to M. Agassiz impossible, that the animals and plants, which appear in different layers of the same geological formation, could have lived successively on the inferior, middle, and superior beds of that formation, since, after the conditions of their existence, and the conditions under which the beds must have been deposited, can neither be reconciled, nor have alternated, as it would be necessary to admit, in order to understand this succession; and if these fossils had really lived in all the stages of a formation, it would be difficult to conceive how certain very thin beds of great extent do not contain on their surfaces, at different intervals, evident traces of life, and of the existence of the organized beings, whose debris we find in the inferior strata, as we find, for example, rolled blocks, fragments of wood, &c. The state of conservation of coprolites, which has been advanced as a proof of the existence of saurians, around which they are found, seems, to M. Agassiz, to prove, on the contrary, that these substances have only been deposited during the *agonie* of the animals from which they were derived; for if they had not been enveloped in the strata which contain them, at the very moment when they were deposited by the animal, it would be inexplicable how we should find bodies so soft still entire, even after being a few hours in the water. Whenever evident traces of slow deposition occur, M. Agassiz believes that such beds should be attributed to periods of comparative repose, and not to formations which have had their origin during cataclysms, in consequence of which the earth has assumed another aspect. It would, therefore, be of importance to distinguish more precisely the different effects produced by destructive causes, which have acted at the surface of the earth. These causes seem to M. Agassiz connected with the nature of the earth, and dependent on its particular organization, much rather than on its external relations with other celestial bodies, and their influence on its surface.*

* Jameson's Journal, No. 38.

PROGRESSIVE INCREASE OF TEMPERATURE AS WE DESCEND IN THE CRUST OF THE EARTH.

For the purpose of ascertaining whether a constant stream of water could be obtained by means of an artesian well, sunk on the south side of the Jura mountains, at the distance of about a league from Geneva, and at an elevation of 297 feet above the level of the lake, M. Giroud, at his country residence at Pregny, bored to the depth of 547 feet without success. Despairing of success, he offered great facilities to any persons who might wish to prosecute the enterprize, for the purpose of scientific inquiry.

On this occasion MM. Aug. De la Rive and F. Marcet made a successful application to the friends of science, and also to the government, and funds were obtained sufficient to enable them to continue the operations during eight months, and to extend the boring to the depth of 682 feet. The hole bored was about four and a half inches in diameter. Water began to appear in it at the depth of twenty feet, and it is worthy of remark, that the height at which the water stood in the opening, as measured from the surface, was lower when the greatest depth was obtained, than it was at half the depth. At 275 feet of depth, the water stood at 14 feet from the surface; at 500 feet it sunk to 22 feet; at 550 feet, to 35 feet. It then rose. At 595 feet, it stood at 24 feet 6 inches, but at 675 feet, it again sunk to 35 feet 8 inches. The result of this praiseworthy effort must operate as a salutary preventive from any farther expensive attempts to obtain running fountains from the theory of an internal communication with the springs on the summits of the Jura.

Having attained the extraordinary depth above mentioned, the experimenter devised the means of ascertaining the temperature of this opening at different depths. As the common thermometer would not answer the purpose, they contrived a self-registering thermometer, constructed on a large scale, and whose accuracy was subject to the most satisfactory tests.

The following Table exhibits the temperature of the bore-hole at the depths specified.

Depth below the Surface in Feet.	Corresponding Temperature.	Depth below the Surface in Feet.	Corresponding Temperature.
30	8.4 Reau.	400	11.37 Reau.
60	8.5	450	11.73
100	8.8	500	12.20
150	9.2	500	12.63
200	9.5	600	13.05
250	10.0	650	13.50
300	10.5	680	13.80
350	10.9		

It thus appears that the increase of temperature below the depth of 100 feet from the surface, as far down as 680 feet, is precisely 0°·875 of Reaumur (=1°·968 or 2° Fahrenheit, very nearly), for every 100 feet. It will be observed, that the increase, instead of moving *per saltum*, as in some other cases, moves with remarkable uniformity. This, the experimenters think, may be owing to the care which was taken in this case to remove and avoid every source of ......

This experiment appears to be the first attempt to ascertain, with any accuracy, the temperature of the earth at considerable depths, among

the mountains of Switzerland. The geological structure of beds which were bored through on this occasion, was as follows:—Next to the upper layer of vegetable earth, sand and gravel, was a gravelly and bluish clay, mingled with soft sandstone (molasse). Below 120 feet commenced a succession of beds of marl and soft sandstone, of various thicknesses, which continued without interruption to the termination of the boring, 682 feet. At 220 feet there was a bed of coarse sandstone (molasse grossiere (two feet thick, with rolled pebbles, a remarkable fact, considering the depth. A strong fetid sulphurous odour was also observed in the layer of yellow marl mixed with sandstone, at the depth of 280 feet, that is near the level of the lake, and a grain of salt was found in the sandstone at this depth. The sulphurous odour again appeared at 600 feet, without the presence of any sulphurous compound that would account for its origin.*

VESUVIUS.

On March 13, an eruption of the mountain took place, when a new crater suddenly opened, and discharged a quantity of stones, &c., amid volumes of smoke. Next day the bottom of this new gulf presented many coloured fires and noises; smoke and flames also issued from the old crater.†

ON THE SILURIAN AND CAMBRIAN SYSTEMS

By Professor Sedgwick and R. I. Murchison, F. P. G. S.

At the last Meeting of the British Association, Mr. Murchison described to the Geological Section, a great group of fossiliferous deposits which rises out from beneath the old red sandstone. To these rocks, which he has termed in descending order the *Ludlow, Wenlock, Caradoc,* and *Llandeilo* formations, (each distinguished by peculiar organic remains, and frequently by subordinate limestones,) it was found essential to assign a comprehensive term, since they constitute one natural system interpolated between the old red sandstone and the slaty rocks of Wales. He observed that it was well known, to all practical geologists, that in consequence of the recent advances of the science, it was absolutely imperative that the term "transition," under which such rocks would formerly have been described, should now be abondoned, since it had been so used, both by Continental and English writers, as to embrace the whole carboniferous series, from which the system under review was not only separated by the vast formation of the old red sandstone, but was specially to be *distinguished* by its fossil contents. Urged, therefore, by many geologists to propound an entirely new name for the class of rocks which had engaged his attention during the last five years, Mr. Murchison recently suggested (See Lond. and Edinb. Phil. Mag., July 1835. vol. 7., p. 48.) that the group should be termed the "*Silurian System*," the name being derived from the ancient British people, the Silures, who under Caractacus made so noble a stand against the Romans, and within whose territory the rocks under consideration are fully displayed. Mr. Murchison then pointed out, that wherever the limestones and typical characters of particular formations were absent or obscure, it was always practicable, over a rigion of 120 miles in length,

* Jameson's Journal, No. 37.

† Literary Gazette, No. 690.

extending from the neighbourhood of the Wrekin and Caradoc hills, in Shropshire, to the west coast of Pembrokeshire, to separate the groups into two parts; the "Ludlow" and "Wenlock" formations, forming the "*Upper Silurian*," the "Caradoc" and "Llandeilo" the "*Lower Silurian rocks*." He further remarked, that in South Wales he had traced many distinct passages from the lowest member of the "Silurian system" into the underlying slaty rocks, now named by Professor Sedgwick the "*Upper Cambrian*."

This communication was illustrated by Ordnance Maps extending over large parts of eleven counties, coloured in the field by Mr. Murchison.

Professor Sedgwick commenced by pointing out the imperfection of the sections exhibited in the North of England, and some portions of North Wales, in consequence of the entire want of continuity between the carboniferous series and the inferior schistose groups. Some of the latter are fossiliferous both in Denbighshire and Westmorland; but in the interrupted sections of those counties it is impossible to tell how many terms are wanting to complete the series to the old red sandstone and carboniferous limestone. In the country described by Mr. Murchison these difficulties do not exist, and his sections have filled up a wide chasm in the succession of British deposits. Professor Sedgwick then described in descending order the groups of slate rocks, as they are seen in Wales and Cumberland. To the highest he gave the name of *Upper Cambrian group*. It occupies the greatest part of the chain of the Berwyns, where it is connected with the Llandeilo flags of the Silurian system, and is thence expanded through a considerable portion of South Wales. In one part of its course it is based on beds of limestone and calcareous slate; but on the whole, it contains much less calcareous matter than the Silurian system, and has fewer organic remains. Beds of good roofing-slate occur, and a perfect slaty cleavage is often observed in it transverse to the stratification; but other parts of it are of a course mechanical texture. To the next inferior group he gave the name of *Middle Cambrian*. It composes all the higher mountains of Caernarvonshire and Merionethshire, and abounds in fine roofing-late, alternating with, and apparently passing into, irregularly interstratified masses of porphyry. Some portions of it are coarse and mechanical, and it contains (for example, at the top of Snowdon,) a few organic remains, and a few examples of highly calcareous slates, but no continuous beds of limestone. The same group, with the same mineral structure, and in the same position, but without organic remains, is greatly developed in Cumberland. The *Lower Cambrian* group occupies the S. W. coast of Caernarvonshire, and a considerable portion of Anglesea: it consists chiefly of chlorite schist, passing here and there into mica schist and slaty quartz rock, and contains subordinate masses of serpentine and white granular limestone. It contains no organic remains. Beneath the *Middle Cambrian* system (above described) there occurs in Cumberland (for example, Skiddaw Forest,) a great formation of dark glossy clayslate, without calcareous matter, and without organic remains. It passes in descending order into chiastolite slate, mica slate, hornblende slate, gneiss, &c., which rest immediately on granite. Whether the *Lower Cambrian* was to be placed on the exact parallel of these masses in Skiddaw Forrest, the Professor did not determine.

Professor Sedwick explained the mode of connecting Mr. Murchison's researches with his own, so as to form one general system. He pointed out also the limit, as at present known, of fossils, none having been hi-

therto discovered in the *Lower Cambrian* schists, and remarked in reviewing the general phenomena, that geological epochs were not effected by shocks, but, like everything in nature, were under the dominion of the usual laws of causation.*

ERUPTIONS OF THE VOLCANO OF THE COSIGUINA, IN NICARAGUA.

One of the most stupendous convulsions of the globe ever known in this hemisphere took place in January, 1835, on the eruption of the volcano of Cosiguina. This volcano is situated in Nicaragua, one of the states of central America, and stands near the eastern promontory of the bay of Conchagua, separating the waters of the gulf from the Pacific. The following is the translation of a report, dated January 29, from the Commandant of Union, a sea-port situated on the western shore of the bay of Conchagua, and the nearest place of any consequence to the volcano.

"On the 20th inst., day having dawned with usual serenity, at eight o'clock, towards the S. E., a dense cloud was perceived of a pyramidal figure, preceded by a rumbling noise, and it continued rising until it covered the sun, at which elevation, about ten, it separated to the north and south, accompanied by thunder and lightning. The cloud finally covered the whole firmament about eleven, and enveloped everything in the greatest darkness, so that the nearest objects were imperceptible. The melancholy howling of beasts, the flocks of birds of all species that came to seek, as it were, an asylum amongst men, the terror which assailed the latter, the cries of women and children, and the uncertainty of the issue of so rare a phenomenon—everything combined to overcome the stoutest soul, and fill it with apprehension; and the more so when, at four P.M., the earth began to quake, and continued in a perpetual undulation, which gradually increased. This was followed by a shower of phosphoric sand, which lasted till eight o'clock P.M. on the same day, when there began falling a heavy and fine powder like flour. The thunder and lightning continued the whole night, and the following day (the 21st); and at eight minutes past three o'clock P.M. there was a long and violent earthquake, that many men, who were walking in a penitential procession, were thrown down. The darkness lasted forty-three hours, making it indispensable for every one to carry a light, and even these were not sufficient to see clearly with. On the 22nd, it was somewhat less dark, although the sun was not visible; and, towards the morning of the 23rd, tremendously loud thunder-claps were heard in succession, like the firing of pieces of artillery of the largest calibre, and this fresh occurrence was accompanied by increased showers of dust. From day dawn of the 23rd until ten o'clock A.M., a dim light only served to show the most melancholy spectacle. The streets, which, from the rocky nature of the soil, are full of inequalities and stones, appeared quite level, being covered with dust. Men, women, and children were so disfigured, that it was not easy to recognise any one except by the sound of their voices or other circumstances. Houses and trees, not to be distinguished through the dust which covered them, had the most horrible appearance. Yet, in spite of these appalling sights, they were preferable to the darkness into which we were again plunged from after the said hour of ten, as during the preceding days.

"At half-past three on the morning of the 24th, the moon and a few

* Philosophical Magazine, No. 42.

stars were visible, as if through a curtain, and the day was clear, although the sun could not be seen, since the dust continued falling, having covered the ground all round about to a thickness of five inches. The 25th and 26th were like the 24th, with frequent though not violent earthquakes.

"The cause of all this has been the volcano of Cosiguina, which burst out on the 20th. I am also informed that, on the island of Tigre, in that direction, the showers of the 21st were of pumice-stones, of the size of a pea, and some even as large as a hen's egg. The earth quaked there more than here; but no houses or other edifices have been thrown down. Here there are many people with catarrhs, headachs, sore throats, and pectoral affections, resulting doubtless from the dust. Several persons are seriously unwell, and yesterday a girl of seven years old died, with symptoms of an inflammatory sore throat. Flocks of birds are found dead, lying on the roads and floating on the sea. The showers of dust lasted till the 27th."*

A LIVE TOAD FOUND IN STONE.

At the Birmingham Philosophical Institution has been read, "An Account of a Toad, found alive, imbedded in a solid mass of new red sandstone." As hitherto, when facts of this kind have been brought before the public, they have been received with the greatest incredulity, we give the depositions of those who were present when the animal, in this instance, was discovered; and we may add, that the block of sandstone, together with the toad, have been exhibited at the rooms of the Philosophical Institution, in Cannon-street.—The following is a copy of the depositions:—

During the progress of the excavation through the Park Gardens, at Coventry, on the line of the London and Birmingham Railway, at about nine o'clock in the morning of the 16th of June, 1835, the workmen were engaged in removing the material to the depth of 11 feet from the surface, the upper portion of the excavation consisting of, first, a stratum of soil, 18 inches thick; then a mixture of sand and clay, 3 feet thick; and the remaining depth of 6½ feet, consisting of masses of new red sandstone, sound and perfectly formed, somewhat severed by backs and fissures, but still in large, solid masses, obliged to be worked away by means of iron bars and wedges, and very frequently blasted by gunpowder.

Two of the workmen, John Horton and Thomas Tillay, having, by means of an iron bar, loosened from the solid mass, near the bottom of the said 11 feet, a piece of rock about 18 inches long, 15 inches broad, and 5 inches thick, it was lifted up by Horton, and thrown by him towards the wagons which were in waiting to receive the excavated material, and convey it to the embankment which was forming across the valley of the river Sherborne. The piece of rock, however, did not alight in the wagon, as was intended, but fell by the side of it, upon the bottom of the new-formed excavation, and was by the fall broken nearly through the centre in two parts, which lay upon the ground, about an inch asunder. Thomas Tillay immediately took up one of the fragments, and threw it into the wagon, and was on the point of taking up the other, when his attention was arrested by the sight of a toad in a

* Jameson's Journal, No. 39.

cavity or cell in the face of the remaining fragment; and, instead of taking it up, he kicked it with his foot, which caused it to fall out upon the ground: he then called to his companion, and told him that he had found a toad in the stone. Horton having joined him, they examined the fracture of the other piece of rock, and found there a corresponding cavity; so that when the pieces were put together, although the stone was to all appearance perfectly solid, yet there was an oval or egg-shaped hole in the centre.

The other workmen, to the number of 30 or 40, soon collected to examine the toad. Its colour, when first seen, was a bright brown; in the space of ten minutes, however, it gradually lost its brightness, and the bright brown became almost a black. The animal seemed to labour under a severe oppression, as from heat or weight, or both combined, and gasped frequently. It was rather under the usual size; but it was plump, and apparently in good condition. During the day, it remained in the possession of the men who found it, and was seen by many persons, and was often exposed to the sun and the warmth of the hand. The head appeared slightly injured, supposed to be occasioned by the breaking of the stone.

About four o'clock in the afternoon, I visited the works; the toad was shown to me, and I fitted one piece of stone upon the other, while the toad was in the recess, and found that the rock fitted closely, and observed no appearance of an opening, or fissure of any kind into the cavity, the stone on every side appeared perfectly solid and sound. A portion of the cavity was much more rounded and smooth than the other, being, as I suppose, the lower side upon which the toad had rested. Throughout the whole cavity there was a thin, black deposit, or lining: but this was more visible on that side which was more rounded, and there were evident marks where this lining was scratched off, as by the claws of the toad.

The cavity was 3 inches long, and 1¾ inches broad; the two pieces of stone, with the toad in them, were brought to my office that evening; and I endeavoured, by closing the fracture of the stone with clay, to exclude the heat and air as much as possible, in the hopes of keeping it alive as long as I could; this I succeeded in doing for more than three days. During this time, however, it was frequently exposed, as there were many persons who were desirous of seeing it; but it seemed to be gradually wasting away: the injury in its head also became much worse, and, doubtless, hastened its decay: it lived, however, nearly four days from the time of its discovery.*

[This statement is signed by the Resident Engineer of the Railway; Horton, Tillay, and a witness to their signatures.

NECK OF ICHTHYOSAURI.

On May 18, a paper was read before the Geological Society, "On a Peculiarity of Structure in the Neck of Ichthyosauri, not hitherto noticed," by Sir Philip Grey Egerton, Bart., M.P., V.P.G.S.

Miss Anning, of Lyme-Regis, discovered, a short time since, in a thin bed of lias shale, near that town, a large portion of the skeleton of a new, gigantic species of Ichthyosaurus. Among these interesting mains are the anterior, cervical vertebræ, together with an occipital

* Analyst, No. 13.

bone; and it is to the peculiarity of structure which they present that Sir Philip Egerton principally confines his observations. The occipital bone, he says, on the authority of Mr. Owen, proves very satisfactorily the permanent separation of the basilar element of the occiput in individuals of the fullest growth and largest size, evincing a very languid circulation in this family of reptiles. The atlas and axis of Ichthyosauri, the author states, are usually found adhering together, the connexion between them being so intimate, that it is rarely possible to disunite them; and when this has been effected, the surfaces have borne the appearance of fracture more frequently than that of natural division. In one instance, in which he succeeded in separating the two bones, the articulating surfaces were nearly even, and without cup. This union of the two vertebræ appears to have received additional strength from a small bone which articulated with the under circumference of the atlas and axis, showing, as the author observes, that in the anterior region of the spinal column, strength and not latitude of motion was required. This bone is a nearly circular, solid, umbonated disc; the central projection being on the inferior or external surface, while the upper is depressed anteriorly and posteriorly for the purpose of articulating with the atlas and axis, the two surfaces being divided by a transverse elevation corresponding with the line of union of the vertebræ. The atlas and axis have their circumferences prolonged in the form of two tangents meeting at an obtuse angle on the under surface. These processes are truncate when the app gular depression for the reception of the two articulating surfaces of the interspinous bone. Sir Philip Egerton states that Mr. Owen has informed him, that a bone somewhat analogous in position, although not in form, occurs in some recent saurians. The apparently two succeeding vertebræ present, at the lower part of their articulating surfaces, an alternating elevation and depression, fitting into each other so exactly, as to limit, to a great extent, the motion between the bones. Some of the other cervical vertebræ are also remarkable for the flatness of their surfaces, the intervertebral cavities being nearly obliterated. In conclusion, the author says, that the conditions under which the atlas and axis are found; the existence of an auxiliary bone connecting the two; the form of the articulating surfaces of the cervical vertebræ, and the consequent contraction of the intervertebral cavities, all tend to prove that the extent of motion in the cervical region of Ichthyosauri was extremely limited, at the same time that its strength was proportionally increased.*

EARTHQUAKE IN CHILI.

On Nov. 19, was read before the Royal Society, the following "Account of the great Earthquake experienced in Chili, on the 20th of February, 1835;" with a Map. By Alexander Caldclugh, Esq., F.R.S.

An idea formerly prevailed among the inhabitants of Chili, that the earthquakes of those regions take place at certain regular periods; but it is now sufficiently proved, from the numerous catastrophes of this kind which have occurred during the present century, that they may happen indiscriminately at all times, and in all states of the atmosphere. The author is disposed to place but little reliance on most of the supposed prognostics of these convulsions: but he mentions that,

* Philosophical Magazine, No. 41.

previously to the earthquake described in the present paper, there were seen immense flocks of sea-birds, proceeding from the coast towards the Cordillera, and that a similar migration had been noticed prior to the great shock of 1822. From his own observations, he concludes that the barometer usually falls shortly before any considerable shock, and that it afterwards rises to its ordinary mean height. Both before, and also at the time of the convulsion, the volcanos of the whole range of the Cordillera were observed to be in a state of extraordinary activity.

The earthquake began at half-past eleven o'clock in the morning of the 20th of February. The first oscillations of the earth were gentle, and attended with little noise: they were succeeded by two extremely violent tremours, continuing for two minutes and a half, the principal direction of the motion being from south-west to north-east; and they were attended by a loud report, apparently proceeding from the explosions of a volcano to the southward. All the buildings of the town of Conception were thrown down during these undulations. At the expiration of half an hour, when the inhabitants, who, on the first alarm, had fled to the neighbouring heights, were preparing to return to their houses, it was observed that the sea had retreated to such a distance that the ships in the harbour were left dry, and all the rocks and shoals in the bay were exposed to view. At this period, an immense wave was seen slowly advancing towards the shore, and, rolling majestically onwards, in ten minutes reached the city of Conception, which was soon overwhelmed in a flood of an altitude of 28 feet above high-water mark. The few persons who had remained in the town, had but just time to make their escape, and to behold from the rising grounds the complete submersion of the city. All objects that were movable were swept away into the ocean by the reflux of this great wave, which was succeeded by several similar, but smaller waves, completing the work of destruction, and leaving behind them, on their final retreat, a scene of universal havoc and desolation.

The island of Santa Maria, which is situate to the southward of the bay of Conception, and is about seven miles broad and two long, remained, after the earthquake, permanently elevated at least ten feet above its former position; and a similar change was found to have taken place with regard to the bottom of the sea immediately surrounding the island. The amount of this elevation was very accurately ascertained by the observations of Captain Fitzroy, who had, previously to the earthquake, made a careful survey of the shores of that island, thus supplying the most satisfactory and authentic testimony to this important fact.

The author gives, in the course of the paper, several particulars relating to the effects of the earthquake in different parts of the Chilian coast; the oscillations appearing to have extended to the north as far as Coquimbo, and to the east as far as Mendoza, at the ridge of the great chain of the Andes. Vessels navigating the Pacific Ocean, within a hundred miles of the coast, experienced the shock with considerable force. Its influence was very perceptible in the island of Juan Fernandez, a basaltic mass 360 miles distant from the coast, as was shown by the sudden elevation and subsidence of the sea, which at one time rose 15 feet above the usual level, carrying all before it.

Philosophical Magazine, No. 45.

FOSSIL BEAKS OF FOUR SPECIES OF CHIMÆRA.

On Nov. 4, was read before the Geological Society, the following notice on the Fossil Beaks of four extinct species of fishes, referrible to the Genus Chimæra, that occur in the Oolitic and Cretaceous Formations of England. By the Rev. W. Buckland, D.D. F.G.S., Professor of Geology and Mineralogy in the University of Oxford.*

About six years ago, Sir Philip Grey Egerton procured from the Kimmeridge clay of Shotover Hill, near Oxford, five remarkable fossil bodies of most curious configuration, in some degree resembling beaks of Cuttle-fishes and Turtles, but not reducible to any known form in either of these families.

In 1832, the Rev. C. Townsend, of Great Milton, near Oxford, discovered in the Portland stone of that village, another series of bones, resembling those from the Kimmeridge clay, but very much larger, and of a different species.

On my submitting these specimens to Mr. Mantell, he immediately compared them with three similar bones in his collection,—one from the Chalk marl of Hamsey, and two from the Chalk near Lewes. These were obviously the same parts of two other species of animals of the same genus. That from the Chalk marl had been shown by him to Cuvier, who could only recognise in it a distant resemblance to the articulating posterior portion of a jaw of a Saurian; but this resemblance was not maintained in the more perfect fragments of other species which had come into my possession from the Kimmeridge and Portland beds.

Mr. Mantell permitted me at this time to prepare a drawing of the fragment from the Chalk marl which he had submitted to Cuvier.

After searching in vain through the best collections in London, and consulting our best comparative anatomists, I could find no animal whose beak or jaws corresponded with either of the forms of fossil bones under consideration.

During the last five years I have lost no opportunity of submitting these fossils to skilful comparative anatomists, and with the same result. My exhibition of several of them to some of the most distinguished anatomists of Germany, at the meeting of the Naturforscher at Bonn in September last, threw no further light upon the subject. The nearest approximation that was suggested to me came from Professor Carus, who advised me to compare the two smallest of these fossils (evidently a pair) with the beak of a *Tetrodon.*

In pursuance of this advice, I examined all the Tetrodons in every museum I visited after my departure from Bonn, and arrived at no other conclusion than the assurance that not one of these supposed fossil beaks could be referred to that genus.

In examining the rich collection in the museum at Leyden, a few days ago, with my friend Professor Van Breda, I found by the side of a *Tetrodon* a skeleton of that rare fish the *Chimæra monstrosa*, of which I had never before seen the bones, and instantly recognised in the upper and lower jaws of this animal the object of my long research. The two intermaxillary bones of the upper jaw corresponded with the pair of tooth-like bones from the Kimmeridge clay, which I had in vain compared with the teeth of the *Tetrodon*; the superior maxillary bones corres-

* Communicated by the author to the Philosophical Magazine, No. 43.

ponded with a second pair of the fossil bones from the same clay; and the lower maxillary of the Chimæra presented the form of the fossil inferior maxillary bones of my four different species from the Portland stone, Kimmeridge clay, Chalk marl, and Chalk.

This discovery of the type of each of these new forms of fossil bones in the mouth of a living species of Chimæra, at once clears up all the difficulties of which I have so long been seeking the solution, and enables me to announce the existence of four fossil species of a genus hitherto unheard of in the annals of Palæontology; one in each of the following four different formations, namely, the Portland stone, Kimmeridge clay, Chalk marl, and Chalk. To that discovered in the Portland stone, I propose to give the name of *Chimæra Townsendii;* to that in the Kimmeridge clay, *Chimæra Egertonii;* to that in the chalk marl, *Chimæra Agassizii;* and to that in the chalk, *Chimæra Mantellii.*

On my submitting these fossils to Professor Agassiz, he at once admitted them to belong to the genus Chimæra, a genus of which the living individuals are extremely rare, and of which he knows not where a single prepared skeleton exists, except in the museum at Leyden.

The only known living species of the genus Chimæra is widely diffused, and is usually found pursuing herrings and migratory fishes: it lives chiefly in the northern seas, and occurs also in the Mediterranean. It is most nearly allied to the family of Sharks, and is from two to three feet long. The cartilaginous nature of its skeleton explains the reason why no other bones of the fossil Chimæra have been found, together with those that form their very peculiar jaws. The hard horny plates which cover these jawbones in the living species, and perform the office of teeth, are in none of our fossil specimens preserved. The two intermaxillary bones of the upper jaw of the *Chimæra Egertonii* have nearly the hardness of enamel, and appear to have had no separable horny covering: the superior and inferior maxillary bones of the same species exhibit rugous surfaces of attachment, from which their horny coverings have been removed. The same marks of attachment are seen in the lower jaw-bones of the *Chimæra Agassizii* and *Chimæra Mantellii.* The horny investment of all these bones has evidently fallen off and perished, like the horny covering which separates readily from the bony beak of Turtles, and which is rarely, if ever, found with the bones of fossil *Testudinata.*

The genus Chimæra is one of the most remarkable among living fishes, as a link in the family of *Chondropterygiens.* The fact of the existence of many fossil species of this curious genus (and some of these much larger than the single known existing species) in such early periods as those of the Oolitic and Cretaceous formations leads to important considerations in Physiology.

Professor Agassiz has at my request prepared the following description of the four fossil species which form the subject of this communication. Further details and figures will be published by him in the eighth number of his *Poissons Fossiles.*

Note by Professor Agassiz.

The discovery of the genus Chimæra among fossil fishes is one of the most interesting and unexpected.

Recent Chimæras are very little known, and have been arranged in the order of cartilaginous fishes, but their organization, and especially the structure of their skeleton, has not been sufficiently studied. Dr. Buckland's discovery will draw the attention of Ichthyologists in a par-

ticular manner to this singular family. The four fossil species about to be enumerated differ essentially from each other, and are considerably larger than the living. Unfortunately the fossil fragments which we now possess are far from being complete; only the jaws of these curious fishes have hitherto been discovered, and principally the lower jaws.

In the Portland species, the *Chimæra Townsendii*, which is the largest, the inferior maxillary is very large, short, and proportionally much thicker, the groove of the symphysis of its two branches shallower, and the cavity of the dental edge broader than in the other species; its exterior surface is convex and furrowed longitudinally with shallow wrinkles. The intermaxillary bone is much bent.

In the *Chimæra Egertonii* the inferior maxillary is short and flat; its snout is truncated, and in proportion very large; the cavity of the dental edge is very wide and the groove of its symphysis very deep; the intermaxillary is much bent, and the dental edge truncated and square; the superior maxillary is irregularly triangular, much elongated, and contracts insensibly towards its dental extremity, which is bifid.

In the *Chimæra Agassizii* of Dr. Buckland the inferior maxillary is the most regular in form of the four species; it is nearly square, and has the dental edge slightly open: the surface of the symphysis is flatter than in the other species.

The *Chimæra Mantellii* has the inferior jaw straighter and thinner: its exterior surface is perfectly smooth and flat, its snout is much elongated and pointed, and the cavity of the dental edge wider.

Since Dr. Buckland's discovery of the above four species, I have found a fifth in the collection of Mr. Greenough, which differs considerably from them all, in the extreme shortness of the lower jaw the length of which is less than its height. The symphysis of the lower jaw is flat; the dental margin truncated and grooved in its hinder part. The external surface is smooth; the middle of the inner surface concave; the intermaxillary is flatter than in the *Chimæra Egertonii*, and terminates in a straight point. The superior maxillary is shorter than that of the *Chimæra Egertonii*.

I propose to give to this species of so remarkable a genus the name of *Chimæra Greenovii*. The locality of this fossil is unknown.*

FOSSIL ORGANIC REMAINS.

Elephant and Deer.—In April, several remains of the elephant and deer were found near Ballingdon, in Essex, about 10 feet above the river Stour, and 100 yards from it, in a bed of flint gravel, with boulders of various other rocks, imbedded in a whitish drift sand. The following is a section of the deposit, and faces the north:—Ferruginous gravel, with flints, &c.; 3 ft. Brown clay, with rounded fragments of chalk interspersed; 2 ft. Fossil bones, in sandy gravel; 7 ft. Coarse drift sand; depth unknown.

The remains of the Elephant are, a tooth of a full-grown elephant. A tooth, apparently, of a young elephant; the tooth being only 5 in. long on the face, by 2½ in. wide. A fragment of a tooth, the same width as the last, viz. 2½ in. Tusks of Elephants; several having been found; but in such a forward state of decomposition, that they perished on the first attack of the atmosphere. A tibia of an elephant, 2 ft. 11 in. in

* Philosophical Magazine, No. 43.

length; truncate at both ends. Part of a femur, 7 in. in diameter. Several other large bones in fragments; the substance of several of these fragments 1 in. thick.

The remains of the Deer are horns of a large species; teeth of a large species; a scapular, and a phalangial bone; leg bones, 9 in. long, 2 in. in diameter.—*Magazine of Natural History*, No. 50.

Elephant.—In the bed of blue clay near Western Road, Brighton, workmen employed by Mr. Lambert in digging a well, found, in January, 1835, at 20 ft. or 30 ft. deep, a cylindrical fragment, 1 ft. long; which was, under Mr. Lambert's direction, preserved, and presented to Dr. Mantell, who pronounced it to be a portion of the tusk of a young elephant. Bones and teeth of elephants have occasionally been found in the same bed of blue clay, at Hove brick-works.—*Bury and Suffolk Herald.*

Elephant.—Two tusks, and a molar tooth of an elephant were lately found in a bed of sandy gravel, at Betchworth, in Surrey, near where the river Mole runs through the parish. The tusks are about 3 ft. in length, and are rather decomposed; the tooth is about 7½ in. long, and has 20 plates, the usual characters of the common fossil tooth. The gravelly deposit is superimposed on the green sand of the district, having an area of two or three miles, and consists of angular and rounded fragments of chalk flints, and the more ferruginous portions of the greensand.—*Magazine of Natural History*, No. 57.

Elks.—On the lands of Castledown, within three miles of Tramore, have been found the skeletons of two elks or fossil deer, of gigantic size; at the distance of about 5 ft. from the surface, in a blue, marly clay, with about 18 in. of turf on the top. The skeletons were found 21 yards apart, both lying on the backs.

Birds.—A paper has appeared, "On the Bones of Birds from the Strata of Tilgate Forest, in Sussex;" by Gideon Mantell, Esq., F.G.S. —Mr. Mantell states, that soon after his attention was first directed to the fossils of the Wealden, he discovered in the strata of Tilgate Forest several slender bones, which, from their close resemblance to the tarso-metatarsal bones of certain Grallæ or Waders, he was induced to refer to birds. The correctness of this opinion was afterwards doubted, in consequence of the thin fragile bones found at Stonesfield, and considered as belonging to birds, being ascertained to be those of Pterodactyles. Having subsequently discovered a few specimens of more decided character, Mr. Mantell submitted them to the inspection of Baron Cuvier, during his last visit to England, who pronounced them to belong to a Wader, probably to a species of Ardea. Still it was doubted whether these remains did really belong to those of birds; but the author's attention having recently been directed to the subject, he placed his specimens in the hands of Mr. Owen, of the College of Surgeons. This gentleman, after a careful examination, pointed out that one bone decidedly belonged to a Wader, being undoubtedly the distal extremity of a left tarso-metatarsal bone, presenting the articular surface, or place of attachment of the posterior or opposable toe. Other specimens of long bones Mr. Owen conceives may have belonged to a more erpetoid form of bird than is now known. From this examination, Mr. Mantell's previous views of the existence of birds below the chalk have been fully established, and, as the author observes, these are the oldest remains of

the class at present known. The memoir concludes with a description of the bones, consisting of a tarso-metatarsal of a Wader, a tibia (?), a metatarsal bone, a humerus, and an ulna.

Fishes.—On November 7, a paper was read before the Geological Society, "On the recent discovery of Fossil Fishes, (*Palæoniscus catopterus*, Agassiz,) in the new red sandstone of Tyrone, Ireland;" by Roderick Impey Murchison, Esq., V.P.G.S.

A small specimen of new red sandstone, presenting the first impressions of fishes found in this formation in the British Isles, having been exhibited before the Geological Section of the British Association at the late meeting in Dublin, Mr. Murchison, in company with Professor Sedgwick, Lord Cole, and Mr. Griffith, visited the spot where it had been obtained.

The quarry is at Rhone Hill, in the parish of Killyman, about three miles east of Dungannon. The new red sandstone in which it is excavated is a prolongation of the deposit which occupies large tracts in the county of Antrim, and extends into this part of Tyrone, where it surrounds a small, slightly productive coal-field, but reposes for the greater part upon mountain limestone. The eastern flank of the district is covered by a vast thickness of clay, containing lignite, the exact age of which is not known; and the surface generally is very much overlaid by loose detritus, consisting of sand and gravel, derived from the adjacent formations. Large blocks of syenite and greenstone, referable to a northern origin, (Antrim,) are scattered here and there.

The beds of new red sandstone exposed in the quarry dip about 15° to the N.N.E., and consist, in the upper part, of red and green marls, passing down into a dark red, thickly bedded, siliceous sandstone, with a few, irregular, highly micaceous way-boards of a deep purple colour. The surface of some of the beds exhibits ripple-marks. The quarry, which is the property of Mr. Greer, is from 25 to 30 feet deep, and the fishes are found only in the bottom beds, but are in great abundance.*

Dr. Agassiz afterwards gave a systematic enumeration of the fossil fishes which he has found in English collections. He commenced by detailing the general results of his researches, from which it appears, that the discovery in England of 300 new species has corroborated the laws of developement which he had previously determined in the succession of these animals during the different changes which our globe has undergone, with the exception of the discovery in the chalk of two species belonging to two genera which he had before observed only in the oolitic series, and of a species of one of those genera in the lower tertiary strata.

The secondary systems, (*terrains*,) of England are the richest in fossil fishes; and Dr. Agassiz stated that the number of specimens which he has seen in English collections is astonishing. The species which he has determined are about 400; but the specimens too imperfect to be described at present, announce the existence of a still greater number.

Their geological distribution presents the following details:—

In the *Silurian system* of Mr. Murchison there are five or six species which exhibit the first appearance and organization of this long series of vertebral animals, the species of which become more and more nume-

* A slab, presented to the Geological Society by Mr. Greer, exhibits, on a surface not exceeding two feet square, above 250 fishes.

rous, and more and more diversified, as well in their forms as in the details of their organization.

The *old red sandstone*, including the Caithness schist and the Gamrie deposit, contains twenty species.

In the *coal measures* there are fifty-four species; in the *magnesian limestone* sixteen.

The *oolitic series* is particularly rich in ichthyolites, the number of species from the lias to the Wealden inclusive being one hundred and fifty.

The *greensand and chalk* are also very rich in fossil fishes, and even much richer than their equivalents on the Continent. The number of English species is fifty.

In the *London clay*, the species perfectly determined are about fifty, but it is certain, from the fragments preserved in different collections, that this formation incloses the remains of a much greater number. M. Agassiz stated that the London clay, particularly in Sheppey, will be, for a long time, an inexhaustible mine.

The *crag* contains five or six species peculiar to it, and belonging to genera which do not inhabit our northern seas.

As an example of what remains to be done in the study of fossil fishes, and of the importance of these researches to zoology and geology, M. Agassiz afterwards described two singular genera found in the lias. One is the animal which has been described under the name of Squaloraia, discovered at Lyme-Regis; the other a new genus, called by M. Agassiz *Gyrostris mirabilis*, and is probably the largest known fish. This fossil was discovered at Whitby; but there have hitherto been found only some detached bones of the head, of the branchial arcs, and some portions of vertebræ and fins; traces of the same fish have been recently observed at Lyme-Regis.—*Philosophical Magazine, No.* 44.

Ichthyolites in the Staffordshire Coal-field.—On June 10, a letter was read before the Geological Society, from Sir Philip Egerton, Bart., M.P., V.P.G.S., "On the Discovery of Ichthyolites in the South-western Portion of the North Staffordshire Coal-field." These ichthyolites consist of teeth, palatal bones, and scales, belonging to the Placoidian order, and to the Sauroid and Lepidoidian families of the Ganoidian order of M. Agassiz. Some of the scales correspond precisely with those of the Megalichthys, described by Dr. Hibbert, from Burdiehouse, near Edinburgh: but the plants associated with the ichthyolites, the author states, on the authority of Professor Lindley, are entirely dissimilar from those found at Burdiehouse. Further particulars are given in the "Proceedings."—*Philosophical Magazine, No.* 42.

Gigantic Reptile.—These remains were discovered near Buckingham, in a bed of clay immediately above the cornbrash. The principal bone is a caudal vertebra of a reptile larger than the Iguanodon. It measures about six inches in its longitudinal diameter, and six inches in the vertical and largest transverse diameters of its articulating faces. Both these faces are slightly convex, and are smallest on the lower side, and depressed on the upper, to form the channel for the spinal marrow. The body of the vertebra is much compressed towards its centre, and the transverse processes are reduced to a small tubercle on each side. On the inferior margin of the articulating surfaces are large oblique facets for the reception of a powerful chevron bone. The form of this vertebra differs essentially from the subquadrangular form of the caudal

vertebræ of the Iguanodon, and it has no perforations on the inferior part of its body, like those which enter the lower side of the body of the vertebræ of the Plesiosaurus. Other bones, of corresponding size, and considered as belonging, probably, to this genus, have been found at Bradwell, a few miles north-east of Buckingham, on the continuation of the same formation.—*Communicated by Dr. Buckland to the Geological Society.*

Icthyosaurus.—Miss Mary Anning has discovered, at Lyme-Regis, the remains of the largest Icthyosaurus ever found. The gigantic animal must have died, and its bones fallen abroad at the decomposition of the body, just before they were covered with lias deposit, which became a layer of limestone. The bones lie, as usual, in the marl between. This animal, presumed to be the skeleton of the *Icthyosaurus Platyodon*, must have been, at least, 35 feet in length, and of considerable bulk.—*Literary Gazette, No.* 952.

Crustacea and Radiata.—On June 10, a paper was read before the Geological Society, entitled "Description of some Fossil Crustacea and Radiata," by William John Broderip, Esq., F.G.S., F.R.S., &c. Lord Cole and Sir Philip Egerton having placed in the author's hands some fossils which they had lately found in the lias at Lyme-Regis, a detailed account is given, in the memoir, of those which he considers to be new.

Crustacea.—The first specimen described consists of the anterior parts of a macrourous Decapod, between Palinurus and the Shrimp family, but of a comparatively gigantic race; and its organization being considered by the author to be *sui generis*, he has assigned to the fossil the name of *Coleia antiqua*, with generic characters which are given in the "Proceedings."

The collection contained the remains of other macrourous Decapods. One of these specimens consisted of a fragment of the post-abdomen, approaching nearest in sculpture to Palinurus, and equaling in size the sea-crawfish: and two others are peculiarly interesting from their exhibiting the tips of the four larger branchiæ, and of the four smaller ones below, pointing towards the situation of the heart, and proving, the author observes, that this crustacean did not belong to the Amphipoda, but to the highest division of the Macroura, of the arctic forms of which it reminds the observer.

Radiata.—Ophiura Egertoni. This species, Mr. Broderip states, approaches very nearly to the recent *Ophiura texturata*, and differs from *Ophiura Milleri* of Phillips, in as much as, among other differences, the disk of the latter is lobated according to the figure given in the "Geology of the Yorkshire Coast." The specimens were found about half a mile west of Bridport harbour, in masses of micaceous sandstone fallen from the cliffs.—*Cidaris Bechei.*

Deposit of Fossil Shells.—In March, Mr. W. Bean examined a deposit of fragile and broken shells which the late high tides had exposed on the north side of the harbour at Burlington Quay. A heterogeneous mass, only a few yards long, and as many high, presented itself, composed of sand, clay, marine shells, and pebbles of every description; chalk and flint were, as might be expected, the most abundant. The colour and appearance of this shelly bed resemble the London clay, but the fossils have the character of those found in the crag formation: the shelly bed contains a greater number of species than have been at present

obtained, and much caution will be requisite ere its geological position can be truly determined. Thus much, however, is certain, that these shells are coeval with, if not of higher antiquity than, the crag. Shells of the following genera have occurred: Dentalium, Balanus, Pholas, Mya, Corbula; Saxicava, a large rugged shell; Psammobia, Tellina; Astarte, four species; Cyprina, Cytherea, Venericardia, Cardium; Nucula, two species, one large and beautiful; Mytilus; Pecten, two species; Ostrea?; Natica, two species; Scalaria; Turbo, a fine pearly shell; Littorina, Turritella; Fusus, four species.—*Magazine of Natural History, No.* 58.

Conia. - A rare species of fossil shell has lately been found in a chalk-pit near Lewes. Mr. Mantell found some fragments of the upper chamber of a similar shell from the same locality, which he has named in his "Geology of the South-east of England" (8vo. edition, p. 130.,) Hippurites Mortoni. The writer is, however, inclined to doubt whether it is a hippurite at all, believing it to be rather a gigantic species of barnacle; and in this opinion he is borne out by the testimony of the able president of the Geological Society, Mr. Lyell. Mr. Lyell, to whom was sent this specimen, with an intimation of my doubts of its being a hippurite, states in his answer, "You are quite right in supposing that your fossil is not a hippurite, but of the Balanus family: it belongs to Leach's genus Conia, a balanus with four, instead of six, divisions or plates; so we have no hippurite from the chalk. It is, however, a beautiful specimen as a Conia; and no fossil Coniæ were known before, as far as I can learn." Similar specimens have been discovered since in the chalk. It is a multivalve shell, hollow at each end, and has the commencement of another attached to it; all round the edge, as may be seen in the drawing, are parts of some bivalve shells firmly attached to it. —*Magazine of Natural History, No.* 58.

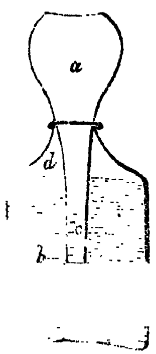
Trees in the attitude of growth in the Coal Measures near Glasgow, have been discovered at Balgray Quarry, immediately adjoining the aqueduct over the Kelvin, about three miles to the north of the city of Glasgow. The quarry abounds in the usual coal plants, laid horizontally; in one part of it a number of trees were found standing in an upright position, throwing their roots out in all directions, to all appearance in the attitude in which they grew, without fracture or disturbance. They rest upon, and are imbedded in, strata of sandstone, which are horizontal, or nearly so. The stems terminate about two feet above the roots, the superincumbent bed of stone passing over them as if they had been cut off. They are about two feet and a half in diameter, and are placed as near each other as trees of the same size could grow. No internal structure was observed, but from the ramification of the roots and of fragments of branches found near them, and the external appearance of the bark, which is channeled or furrowed, the author presumes that they were dicotyledonous.—*Mr. J. Smith, F.R.S., Proceed. Brit. Assoc.*

Tree.—A large tree has been discovered in a stone quarry at the Milton of Balgoine. The account states it to have been lying nearly horizontal, and attached by about two-thirds of its circumference to the sandstone. It is 15 inches in diameter, and wholly composed of white sandstone, similar to that in which it was imbedded. The quarry is remarkably rich in vegetable impressions. Casts or marks of palm-trees are to be found in great beauty and abundance.—*Sunderland Herald.*

METEOROLOGY.

A SIMPLE INSTRUMENT FOR INDICATING THE CHANGES OF THE WEATHER.

THE annexed barometer appears very correctly to indicate the changes of the weather. It consists of a long-necked bottle reversed in a jar of water; the bottom of which being covered with quicksilver, the water will rise or fall in the neck of the bottle according to the changes of the weather. The sketch will assist the above description:—*a*, empty bottle; *b*, jar filled with water to *d*; *c*, index marked upon the neck of the bottle, in which the water rises and falls; *e*, quicksilver sufficient to cover the bottom of the jar. Barometers upon this construction are made by Mr. Naylor, glass manufacturer, Vere-street, Oxford-street. They act by the pressure of the atmosphere upon the surface of the water, which, as the pressure varies, causes the water to vary in its height in the tube; but, as the volume of air in the inverted vessel will also be acted on by the temperature of the atmosphere, barometers of this kind cannot be so accurate as the common mercurial barometers.*



THE AURORA BOREALIS.

Written for the present work, by Dr. Armstrong, Vauxhall, Nov. 30.

THE aurora borealis has made its appearance with greater or less distinctness, on every clear and calm evening since the middle of October. Its features, however, were not remarkable enough to attract notice; but they were sufficiently well defined to convince the accurate and practised observer that they pertained to that class of phenomena called northern lights. In close connexion with this class of phenomena is, doubtless, that luminousness which has, of late years, been very conspicuous in the Arctic skies, from immediately after the autumnal, to the vernal, equinox. Nor is this connexion the less obvious, though the brightness alluded to be unmarked with the usual resemblances and more recognised features of the aurora. On Nov. 18, the metropolis and its vicinity were surprised, and, in several instances, thrown into very ludicrous perturbation, by a singularly beautiful, if not awful, exhibition of this phenomenon.

The night was calm, and the skies clear and starry, except in the north, where a filmy cirrostratus cloud, somewhat darkened the heavens to an elevation of about 25°, slightly curved to the horizon. Through this cloud, owing to several apertures therein, the stars were visible; and two or three could be occasionally observed through the intervening film

* Gardener's Magazine, No. 69.

itself. The cloud extended from N. to N.E.; the upper portion of it forming the base of the phenomenon. The appearance of this cloud, about seven o'clock, when my attention was first directed to it, was not well defined; but, from its higher edge, and throughout its whole extent, were emitted faint vertical streams of coloured light (the red prevailing), which diminished in altitude, and most frequently in brilliance, in proportion to their distance eastward and westward from the northern part of the cloud. Their lines of direction were sometimes divergent, like radii when they escape from part of a periphery; and sometimes converging towards the zenith. The streams which issued from the more elevated portion of this cloud, usually reached the zenith; not beyond. I have said that the cloud was not well defined; but it might have been so only to my view, owing to the glare of gas lights on each side of me whilst I made these observations. About half past seven, the aurora assumed a different appearance, which was the second scene in this atmospheric exhibition. Instead of throwing up vertical columns, it emitted long horizontal flashes—the term billows is more descriptive—extending the whole length of the cloud, which was now considerably arched. These ascended to the zenith, or nearly so, at irregular intervals, varying from half a second to two seconds. I must here advert to a peculiarity (not unusual, however,) in their ascent, which was effected not at one flight, but at two flights, or more frequently three; the first being the brightest, and the third very faint and indistinct. Again, the light would ascend, not in one continued billow, but in three distinct divisions; sometimes simultaneously, at others in rapid succession, and with the speed of lightning. Notwithstanding the immense velocity of these horizontal billows, it was quite observable that they were not successive illuminations of different places of the atmosphere, at various altitudes, but a real progress of light: that the motion zenithward was as real as that of the vertical streamers, and that the difficulty of distinguishing whether the apparent flash in each flight was mere local illuminations, or light emanating from the cloud, but interrupted in its flight to the zenith, arose from the longitudinal direction of the wave, whereby the eye was prevented from observing the reality of its ascent with that precision and facility with which it reckons the progress of a pencil of vertical light shooting upwards. The arched cloud continued throwing up these illuminated waves, till about nine o'clock. At this time they nearly ceased; and in proportion as the phenomenon became more tranquil, the higher portion of the cloud became more regularly curved, better defined, and also striated. It ultimately resolved itself into what is called a lunar rainbow, and exhibited the red and yellow hues throughout; and this was the third scene. From each end of the arch arose bright and steady columns of light to a height of from 10° to 20°, appearing and disappearing at intervals varying from 20 seconds to a minute. The mean breadth of the arch, when most uniform, was 4°; its upper edge shining, and its apex passed through the arcuated portion of the Greater Bear, and made, during the whole time I witnessed it, a segment with the horizon of about 120°.

The haze which usually lingers about the horizon of our smoky metropolis prevented me from observing, with accuracy, whether the extremities of the arch was based in a cloud or on the horizon. My impression was, that it was based in a cloud. The southern sky was cloudless; and it is a fact worth mentioning, that the meteors called shooting stars, of which I observed ten, were generated in the southern hemi-

sphere, and invariably shaped their course towards the aurora. But in the northern heavens, and within the range of the illuminated atmosphere, I observed a fire-ball (alt. 60°, and azimuth 50° from N. to W.), twice the apparent size of the planet Venus, but much brighter than it. It appeared for the space of three seconds, when it vanished without leaving the least train, or any luminous particle whatever. Its motion was directly downward, at right angles to the horizon. I saw this meteor from first to last, and the space described in its descent was 1° 30′, and not more. Meteorologists will understand why I advert so particularly to this meteor, more especially when I tell them that it was immensely beyond the aurora. But of this anon. The arch maintained, during the whole time of its appearance, its relative position among the fixed stars, without any appreciable diminution in height or in extent; a circumstance which proves satisfactorily, if proof were necessary, that the phenomenon is of atmospheric origin, and that the diurnal rotation of the earth has no effect on its apparent position. The aurora borealis lasted till midnight, when it gradually vanished, beginning at the east. I heard no noise whatever that I could attribute to the phenomenon. Streamers I have frequently seen, and have heard their noise, many years ago, in the north of Scotland. It very much resembled the rustling of a parasol, when quickly and repeatedly opened at a little distance. I now speak of streamers ascending with great velocity. But the horizontal, billowy masses of illuminated air, exhibited in the late phenomenon, moved with equal velocity to that of the streamers, and frequently with much greater. They must, therefore, in all such apparitions, meet with greater resistance in their progress, and, consequently, must be accompanied with a noise of some description or other. Now, since this noise is not heard distinctly, if at all. (in as far as I have heard) by any person, I cannot help supposing that the horizontal lights are much farther distant than the vertical.

The circumstance of the fire-ball having appeared far beyond the aurora, demolishes the opinion entertained by some, that the aurora is beyond the atmosphere. And if it be true what Euler says, that the apparition is 1,000 miles above the earth, then must it be true that the fire-ball was vastly beyond that distance. Indeed, I feel much more inclined to lay aside all my previous opinions in reference to the limits of the atmosphere, and to suppose that it extends to a much greater distance than 1,000 miles. I feel, I repeat, more inclined to do this than to impugn even the most cursory hypothesis of that great man. If it be asked how I am so certain that the meteor was really beyond the aurora, I answer that, if it had shone on this side of it, or nearer the earth, it would have affected, by its brilliance, a portion of the aurora, equal at least to its own apparent bulk. Now, it produced no more in this way than the stars that were seen through the illuminated atmosphere at the same time, and nearly in the same quarter of the heavens. The greater distance from the earth of the fire-ball than of the aurora, was as manifest as would have been the superior distance of Venus, had that planet appeared in the same place and for the same space of time. Of course I cannot be supposed to institute a comparison between planetary and meteoric distances. I am as positive that the fire-ball was beyond, and higher than, the aurora, as I am that the fixed stars were beyond and higher than the meteor.

In the northern parts of the kingdom, the phenomenon which I have endeavoured to describe was accompanied with violent tempests, with

which the southern parts were visited on the day succeeding. Whether the disturbed state of the atmosphere is attributable, (as Mr. Adams, of Edmonton, seems to think,) to the perihelic distance of the comet, or is in any way connected with the present situation of that body, or with any vicissitude it may have caused, or have undergone in consequence of its proximity to the sun, is a question for those searching calculators and profound inquirers who have all along predicted its appearance, and its course, and ascertained its periods and elements with precision so unerring and success so marvellous. An unusual display, (such as we have just witnessed,) of the northern lights is said to prognosticate a severe winter. A very short time will testify the wisdom of this prediction.

APPEARANCE OF HALLEY'S COMET.*

COMMUNICATIONS have appeared in the daily journals from the Rev. Dr. Hussey, and from Sir James South, from which we derive the following particulars of the discovery of Halley's Comet, in its approach to the Sun, by those astronomers.

The Rev. Dr. Hussey observed the Comet at the Rectory, Hayes, Kent, on the mornings of Sunday and Monday, August 23 and 24, and gives for its approximate place AR 5h 42m 20s, N. Decl. 23° 45′ 20″; stating it to be very large, but the faintest object the eye can distinguish, in an achromatic telescope of 6·5 inches aperture; and comparing it, in another communication, to the finest smoke.

Sir James South also observed the Comet at his Observatory at Kensington, in the form of a round, well defined, but extremely faint nebulous body, perhaps 2 minutes of space in diameter, on Sunday morning, August 23, at 1 hour 11 minutes sidereal time; in about AR 5 hours 42 minutes 31 seconds; and N. Decl. 23° 43′. On Monday morning, August 24th, at 23h 55m 47s sidereal time, its place was AR 5h 43m 18s, N. Decl. 23° 49′ 43″.

The place assigned to it in the Nautical Almanac, for August 23, is AR 5h 42m 56s, N. Decl. 24° 45·3; so that, as Mr. Lubbock has remarked, the agreement with calculation of its observed place is as near as could have been hoped for.

It is stated in a foreign journal, that a letter had been received from Prof. Encke, announcing that the Comet had been discovered by M. Kunowski at Berlin on the 22nd of August.

In addition to MM. Damoiseau, Pontecoulant, and Rosenberger, who have each gone through laborious calculations requisite to predict the return of this Comet, Dr. Lehrman has also investigated this question and arrives at very different conclusions. According to this mathematician the Comet will pass through Ursa Minor, and the time of the perihelion passage which he assigns is ten days latter than that previously determined. Dr. Lehrman has given his results in two recent numbers of the *Astronomische Nachrichten*.†

* Philosophical Magazine, No. 39.

† M. J. Muller, assistant in the Observatory here, (Geneva), again saw Halley's comet on the night of the 31st of December. It was very faint indeed, but precisely in accordance with the calculation of Professor Gautier, director of the observatory. M. Muller directed his telescope at the minute given to the spot designated, and saw the comet really ap-

ON THE AURORA BOREALIS.

By Sir John Ross.

HAVING observed in his first arctic expedition that the aurora sometimes appeared between the two ships, and also between the ships and the icebergs, and found in his subsequent experience, both in Scotland and during the second arctic voyage, proofs satisfactory to his own mind that the aurora takes place within the cloudy regions of the earth's atmosphere, Sir John Rose states the following hypothesis on the subject, viz. "The aurora is entirely occasioned by the action of the sun's rays upon the vast body of icy and snowy plains and mountains which surround the poles."*

SOLAR AND LUNAR HALOES.

MR. W. H. WHITE says, from repeated observations, during a period of more than ten years, I conclude that both solar and lunar haloes are heralds of succeeding changes of weather from dry to moist; as rain generally follows in periods of from four to twenty-four hours after each manifestation, according to the brilliancy of its appearance, and the perfection of the halo, particularly if the wind be S. or S. W. And that these indications generally precede the indications of the barometer, may be accounted for thus :—As the lower stratum of the atmosphere becomes condensed (from contrary currents or other causes), it is better qualified to concentrate by reflection the rays of the sun or moon: and hence a halo is formed before the atmospheric pressure is sufficient to act upon the barometer.

Lunar haloes are more easily discovered than solar haloes, because the lunar rays are more feeble than the solar; but solar haloes may be readily discovered, if observers would accustom themselves to look steadily within a few degrees of the sun, when he has risen from 10° to 30°; and also when he has about the same altitude in the evening, (as solar haloes are of very rare occurrence at mid-day), when they perceive he shines faintly, and there is no appearance of cloud. Solar haloes are usually the most perfectly formed, and exhibit the prismatic colours the most distinctly on the *vesiculæ* of haze or thin vapour, on attenuated cirrostratus clouds, and sometimes on thin cirrocumulus.†

GROUND ICE.

THE Rev. J. Farquharson, in his paper lately read before the Royal Society, on the formation of ice at the bottom of rivers and running streams, states that the phenomenon is quite common in our climate; he quotes the opinions of M. Arago—with which he does not agree—Mr. Easedale—Mr. Knight, the celebrated botanist, and several other writers on the same subject; he attributes it to the radiation of heat from the bottom of the river or stream. He made a number of experiments in the Don, and another river, a tributary of the Don, in the beginning of January this

pear and pass across the object glass. This was on the 31st of December, at night, at 12h. 45m. 15 1/7s. astronomical time, or 5h. 56m. January 1, civil time. Right ascension, 16° 18½′, and south ascension, 24° 44′.—Geneva, Jan. 4.—Literary Gazette, No. 993.

* Proceedings of the British Association.

† Magazine of Natural History, No. 53.

year, from which it appeared that the ice at the bottom, or, as it is called, *ground grue,* does not resemble the glass-like plates, formed on the surface, but is a cavernous mass of varied size, adhering together, rudely symmetrical, like the head of a cauliflower, of a shining and silvery whiteness. By the accumulation of such masses, streams are often raised above their usual level, much to the surprise of those persons who are not acquainted with the cause: horses, it appears, are aware of the presence of the ice; for where it is found, they refuse to ford accustomed rivers, finding it to yield under their feet. The author most commonly found this ice when the sky was clear, a circumstance altogher at variance with the result of Arago's inquiries, who states that he never met with it, except in cloudy weather. Mr. Easedale attributes its appearance to hoar-frost, falling to the bottom, like a precipitate; as he says, however, that it is frequently present during the continuance of windy weather, the author also controverts this' opinion. Experiments were carried on by him during the first three or four days of last January; the thermometer, on these occasions, stood at 47, 23, and lastly, at 19, Fhr., on the different days; he found the bottoms of the rapids in the Don covered with the ice on each day. The author then, by analogy, argues that the phenomenon is neither more nor less than the same process observed on land, produced by the cooling of the earth's surface, in consequence of the radiation of heat, modifications of which take place on many trees by the effect of shade.*

FALL OF FISH.

One of those curious phenomena, the fall of fish, is stated to have occurred on the 17th of May near Allahabad, when a storm from the west, which extended, apparently, about four hundred yards, having passed over the country, three or four thousand fish of the chalwa species (*Clopea cultrata*) were found scattered, dead and dry, upon the ground. The nearest tank where the fish occur, is half a mile south, the Jamna three miles south, and the Ganges fourteen miles north by east of the place.†

COMETS.

His Majesty the King of Denmark has been pleased to found a gold medal, of the value of twenty ducats, to be given to the first discoverer of a telescopic comet, subject to the following conditions, which are, in some respects, different from those published in the year 1832.

1. The medal is to be given to the person who may first discover a telescopic comet, (that is, a comet not visible to the naked eye at the time of its discovery) and not of known revolution.

2. The discoverer, if in any part of Europe except Great Britain, must send *immediate* notice to Professor Schumacher, of Altona; and, if in Great Britain, or any other quarter of the globe except Europe, must send *immediate* notice to Francis Baily, Esq., of Tavistock Place, London.

3. Such notice must be sent by the *first* post after the discovery, and, in case no post should be established in the place, then by the *first* conveyance that presents itself, without waiting for more observations. A strict attention to this condition is absolutely necessary, for, when it is

* Literary Gazette, No. 951.

† Literary Gazette, No. 951.

not complied with, the medal will not be awarded at all, if there be only one who has seen the comet; and, where it has been seen by more than one, it will be given to the discoverer next in order of time who does comply with this condition.

4. The first notice should contain, not only the time of the discovery, as nearly as the same can be ascertained, in order to avoid any disputed claims, but also the best possible determination of the position of the comet, and the direction of its course, if these points can (even approximately) be ascertained from the observations of one night.

5. If the first night's observations are not sufficient to determine all these points with sufficient accuracy, the discoverer must, as soon as he gets a second observation, send another communication as above directed, together with a statement of the longitude of the place, if it should not be a known observatory: but the hope of getting a second observation will not be admitted as an excuse for delaying the communication of the first.

6. The medal is to be adjudged twelve months after the discovery of the comet, and no claim can be admitted after that period has elapsed.

7. Professor Schumacher and Mr. F. Baily are to determine whether a discovery is to be considered as established or not: but, should they differ in opinion, Dr. Olbers, of Bremen, is to decide between them.

N. B.—Professor Schumacher and Mr. F. Baily, have undertaken to communicate to each other, respectively and *immediately*, such information as they may receive relative to the discovery of these comets.*

BAROMETRICAL OBSERVATIONS, BY SIR JOHN HERSCHEL.

Barometric Comparisons.—1. Sir John Herschel's fine mountain barometer having been accurately compared with the Standard barometer of the Royal Society, accompanied him in an extensive scientific tour which he made through France, Germany, Switzerland, Italy, and Sicily, and was on that occasion successively compared with the other barometars in the principal observatories of Europe. On his return to England it was again compared with the Standard of the Royal Society, and although it had ascended with Sir John to the craters of Vesuvius and Etna, (in the latter case "under circumstances very trying to the instrument,") it was found to give the same difference within the three-thousandth of an inch as that obtained in the first instance before setting out. 2. In 1832, the same mountain barometer was lent to Professor Henderson, on his going out as Astronomer Royal to the Cape, and, having been compared both on setting out, and again in the following year on his return, the second difference was on this occasion the same as in the former case,—namely, only the three-thousandth of an inch. 3. Before Sir John Herschel's leaving England in 1833, it was again compared with the Royal Society's Standard, (giving the same difference as before,) and, on his arrival at the Cape, was compared with the barometer of the Royal Observatory in that colony; the determination of altitude in this latter instrument, as compared with the Royal Society's, by the intermedium of the mountain barometer, being the same within the five-thousandth of an inch as made on the former occasion by Professor Henderson; the mountain barometer having, in the course of these comparisons, made three voyages to and from the Cape.

* Athenæum, No. 419.

Meteorological Festivals.—The South African Literary and Philosophical Institution, at the instance of Sir John Herschel, have appointed a standing Meteorological Committee, to collect observations, and reduce them; and, among other regulations, have passed the following resolution,—"On four fixed days in each year, 21st of March, 21st of June, 21st of September, and 21st of December, (unless any of these days should fall on Sunday, in which case, for the 21st substitute the 22nd,) we undertake to make horary observations of the barometer, thermometer, wet and dry thermometer, clouds, winds, meteors, &c. &c. at the commencement of each hour (per clock) mean time at the place, for thirty-six hours; beginning at six o'clock in the morning of the 21st, and ending at six o'clock in the evening of the 22nd. Thus a complete twenty-four hours is sure to be embraced in corresponding, or, at least, interpolable* observations *for all longitudes.*" Sir John Herschel has drawn up a brochure on this subject for South African distribution, and we trust our contemporaries will give the aid of their columns, to circulate as widely as possible the above resolution of the South African Institution; and thus, as Sir John observes, "if possible, get meteorologists in England and elsewhere, by land and by sea, over the whole globe, to set apart these four days as great meteorological festivals, when every man is to be at his post."

Equatorial Depression.—Sir John Herschel, in the observations made during his voyage out to the Cape, remarked the interesting phenomenon, that "the barometer under the Equator has a *lower mean altitude* than in north or south latitude, and that the increase of altitude is steadily maintained at least as far as either tropic—the equatorial depression amounting to about two-tenths of an inch. The physical cause is not far to seek. It consists in the *upward suction,* which is the immediate consequence of the overflow of the equatorial atmospheric column into the extra-tropical regions, and which is not immediately compensated by the under-current of the Trades. *It is a dynamical result, into which time enters as an essential element. In this (as in the tides) equillibrium is not established instanter,* and this gives room for the developement of appreciable differences of tension in different parts of the circuit."

Barometric Fluctuation.—Sir John Herschel states that he has, since his arrival at the Cape, been collecting data for an inquiry into the laws of barometric fluctuation in those regions, and having, fortunately met with a fine series of fifty-seven months' observations by Capt. Bance, registered in Cape Town, he has undertaken the labour of reducing them. "They exhibit an extremely regular fluctuation of three-tenths of an inch, by which the barometer stands higher in July than in January. On the other hand, by the Calcutta Registers, as published by Prinsep, for the last two years and a half, it appears that the reverse obtains there,—the barometer standing higher in January than in July by about ·52 inch. Thus, it appears that there is an annual bodily transfer of a certain considerable mass of air from hemisphere to hemisphere; and of this, too the cause is obvious, being the more heated state of that hemisphere over which the sun is vertical, in comparison with that on which he shines obliquely."

* Extracts from, and abstracts of, a Letter from Sir John Herschel to J. Hudson, Esq., late Assistant Secretary to the Royal Society, dated January 8, quoted in the Athenæum, No. 391.

METEOROLOGICAL SUMMARY OF 1835.*

MONTHS.	TEMPERATURE. Max.	TEMPERATURE. Mean.	TEMPERATURE. Greatest Variation.	ATMOSPHERIC VARIATIONS. Mean Pressure in Inches.	ATMOSPHERIC VARIATIONS. Prevailing Currents.	MEAN DEW POINT.	LOWEST DEW POINT.	MODIFICATIONS OF CLOUD. Cirrus.	Cirro-stratus.	Cumulus.	Cirro-cumulus.	Cumulo-Stratus.	Nimbus.	Stratus.
JANUARY	53	36·5	23	29·96	SW. W. NE.	34·2	10	·	+				·	
FEBRUARY	57	40·5	33	29·975	SW.	24·9	19	·	+				·	
MARCH	58	43	30	29·42	SW. NW. NE.	39·2	20	·	+	·		+	+	
APRIL	73	50	43	29·825	SW. NW.	43·5	27		+			+	·	
MAY	80	60	40	29·60	SW. NW. NE	46·7	28		+	+	·	+	+	
JUNE	85	45	45	29·565	SW. NW. W.	50·4	36		+	+	·	·	·	
JULY	91	69·5	43	29·675	SW. E.	54·3	42	·	+	+	+	·	·	
AUGUST	88	67	42	29·70	S. SW.	55·4	47		+	+	+	·	·	
SEPTEMBER	80	60·5	39	29·50	SW.	52·3	37	·	+	+	·	+	+	·
OCTOBER	68	46·75	40·5	29·24	SW.	44·7	32		+	·	·		·	
NOVEMBER	58	44·5	27	29·51	SW. SE. NE.	49·6	26		+		+			
DECEMBER	55	37	36	29·74	NE. NW. SW.	37·7	14		+		+		·	

Number of Days for the greater part cloudy	82	Number of Days for the greater part rainy	20
,, ,, ,, ,, clear	75	,, ,, fair	57
Number of Days throughout cloudy	169	Number of Days throughout rainy	8
,, ,, ,, ,, clear	58	,, ,, fair	279

The variations of temperature are ascertained from a self-registering thermometer, graduated by Ronketti, suspended at an elevation of twenty-eight feet from the ground, and facing the north.

The averages of atmospheric pressure are results of observations taken, three times a day, from a traversing barometer by the same maker.

The highest winds were from a westerly quarter, and occurred on Feb. 5th, 7th, 8th, 22nd, 23rd, 26th, 27th; March 6th, 7th; Sept. 11th; Oct. 25th; and Dec. 19th.

Thunder and lightning on April 22nd; May 15th, 27th; June 7th, 9th, 17th; August 20th, and 25th.

Meteors of unusually frequent occurrence throughout the year. A splendid Aurora Borealis on Nov. 18th, of which an account is given at pages 274—5 and 6 of this work. A little Snow on January 19th; February 10th; April 16th, 17th; and December 20th.

In the section of the Table comprehended under "*Modifications of Cloud*" the crosses indicate the prevailing cloud of the month; and the dots signify the clouds which were of rarer appearance, and at the head of the columns are the names by which the clouds are usually known to Meteorologists.

* Constructed for, and communicated to, this work, by Dr. Armstrong, Vauxhall.

RURAL ECONOMY

Victoria Wheat.—Experiments have lately been made in the island of Jamaica, under the scientific auspices of the philanthropic Dr. Bancroft, with wheat sent by Sir Robert Kerr Porter, first to England, from Caraccas, and thence to Jamaica, the results of which experiments are stated as follows:—

"The Jamaica Agricultural and Horticultural Society have received samples from three or four different places, of the wheat produced there, all of which appear to be of a favourable sort.

"First, from the mountains of St. Anne's, where the seed had been *sown the latter end of January*, and the corn *was ripe the latter end of April*. In another part of the same district, the dates of sowing differed from the above, but the wheat ripened in nearly the same period.

"Next from the mountains of St. Andrew's. On one property, Fair Hill, (about 2,000 feet above the sea) the sowing and the ripening happened at the same dates as in the first mentioned case. Of this corn, *one grain* produced *twenty-eight ears*, containing altogether *fifteen hundred grains*, (being an average of fifty-three grains for each ear). Notwithstanding this apparent success, the proprietor of the place thinks it unlikely that planters would grow the Victoria Wheat in preference to the *Great Corn*, as it is called here, i. e. *Zea Mayz*. On another plantation again, Charlottenberg, (about 4,000 feet above the level of the sea,) the seed was sown early in March, and received a top dressing: in the course of a few days it had already sprung up three inches above ground; and, as favourable moderate rains continued to fall subsequently, the corn throve well, and ripened in the early part of June, producing abundantly grain of a larger size than the parent seed; the ears being large and full. Six of these, for instance, yielded *three hundred and thirty-six grains, weighing three ounces*, making *an average of fifty-six grains, weighing half an ounce*, to each ear. Mr. W. B. King, an assistant Judge of Assize, and member of Assembly, has since sent me two bundles of the ears of his wheat, and I intend to inclose one or two of them as a specimen of the produce of the Victoria wheat here. From the trial, just made, Mr. King has no doubt that this grain could be cultivated in many parts of this island, and that it might become a profitable resource."

The wheat which was the subject of these experiments, was of that kind cultivated in the environs of La Victoria and San Matheo, spoken of by Humboldt, in the fourth volume of his Personal Narrative, as being sown there in the month of December, and the harvest reaped on the seventieth or seventy-fifth day, an interval corresponding with singular accuracy with the account given above by Dr. Bancroft. Of this wheat Humboldt says, that its grain is large, white, and abounding in gluten; having a thinner and softer pellicle than that of the wheat raised on the cold table lands of Mexico. He states the produce of an acre (*arpent des eaux et forets*, or legal acre of France, of which 1·95 make an hecture, being equal to about one acre and a quarter English,)

as amounting usually from three thousand to three thousand two hundred pounds weight, being at the rate, for an English acre, of from two thousand one hundred and sixty to two thousand five hundred and sixty pounds; the growth of what we may conclude to be an alluvial soil, from what Humboldt says, at page 101, of the aspect of the situation of Victoria, the approach to which was marked by the ground becoming smoother, and looking like the bottom of a lake, the waters of which had been drained off, while the neighbouring hills, only one hundred and forty toises in height, were composed of calcareous tufa; their abrupt declivities projecting like promontories into the plain, and seeming by their form to indicate the ancient shore of the lake. The elevation of the cultivated ground is fixed by Humboldt at from 270 to 300 toises (about 1726·51, to 1918·35 English feet) above the level of the sea, an elevation from 81·65 to 273·49 English feet below that of Fair Hill, in the mountains of St. Andrews, Jamaica, where a single grain yielded from twenty-eight ears a return of fifteen hundred for one.

The seed was obtained direct from Caraccas, where Sir Robert Kerr Porter procured it from the place of its growth, and was transmitted a second time acoss the Atlantic, to Dr. Bancroft; hence no doubt can be entertained of its being the genuine wheat spoken of by the illustrious traveller from Prussia.—*West of England Journal, No.* 4.

Symphytum Asperrimum; or, Prickly Comfrey.—A new species of green food for cattle. A hardy perennial of gigantic growth, introduced from Caucasus, as an ornamental plant in 1801, by Messrs. Loddiges, of Hackney, as specified in Curtis's *Botanical Magazine*, where it is figured, No. 929. Horses, cows, sheep, pigs, and geese may be fed with it; and as it is of wonderful growth, and may be cut successively from April to October, it may be cultivated to great advantage. For horses, to be put in the racks, spread on pastures, or the green stalks to be cut with chaff, it will be found most useful. Two out of three will take it at once, the others will soon follow, and when once the taste is acquired, they will never leave it. Cows do not take it at first so freely as the horse, but soon take it and are eager for it. For sheep or lambs it is very good; they will take it freely, the latter before they are a month old. It is a very early plant, and immediately follows the turnips. The first crop of leaves to be fed off before the flowering stalks rise, care being taken not to feed too hard, so as to damage the crowns of the plants. Spread on pastures, put in racks or folds on fallows, it will be found of great service. For pigs it is very useful; they eat it freely and do well. Geese will eat it as soon as hatched. It will grow in all soils and situations, superior to any other plant, and may be planted by the sides of ditches, in any waste corner, fields, orchards, gardens, &c., where only useless rubbish grows. The only expense is, the purchase of a few in the first instance, as it may be increased to any quantity, and, once established, will last for ever. I know some that have stood more than twenty years, and are as full of vigour as they have ever been. It is now ready for cutting (March 31st). I have cut it when more than seven feet high, and as thick as it could stand on the ground. I once cut and weighed one square rod; the average was seventeen tons, three cwt. per acre. I have no doubt but that in the course of the year the produce would have been thirty tons. I cannot say what effect continual cutting may have on this plant, or on the land, for many years together; but as far as I have experienced, it does not weaken the plant. I have cut it three times in one year, and found it equally strong the following

spring. The proper distance for planting it is from two to five feet square, according to the quality of the land. It may be planted at any time of the year, but, like other herbaceous plants, is best when in a growing state.—See a letter to Lord Farnborough, signed Dr. Grant, in the *Northampton Herald and General Advertiser*, Saturday, October 10, 1835.

The Lawton Hybrid, a New Turnip.—We have to introduce to the notice of agriculturists, another new and valuable turnip for field culture. This variety is a hybrid between the *green-topped Swede* and the *green-topped white Globe*, raised by James Wright, Esq. of Lawton, Strathmore, Perthshire. Hence the name. From trials which have been made in various parts of the country during the last season, this variety seems deserving of cultivation. It is a white turnip with a green top, and possesses the advantages of being hardier, and yielding a greater crop than any other of the white turnips at present cultivated in the fields, qualities which render it well worth the attention of farmers.—*Quarterly Journal of Agriculture*, No. 28.

The Annat Barley, a new variety of Barley.—This new and seemingly very superior variety, is the produce of three ears which were picked by Mr. Gorrie, Annat Gardens, in a field on the farm of Flawcraig, Carse of Gowrie, Perthshire, in the harviest of 1830, since which period it has been grown at Annat Gardens. Hence its name. Last season it was sown on a ridge in the middle of a field with *Common* barley on the one side and *Chevalier* on the other. In the bulk of straw it seemed to have the advantage of both these kinds; it was five days earlier ripe than the former, and about a fortnight before the latter; and it was also 2½ lb. per bushel heavier than the *Chevalier*. From the *Annat Barley* being of so recent introduction, it will be two years at least before a sufficient quantity of seed can be procured to render it the subject of extensive cultivation.—*Ibid.*

Animalized Carbon, a new manure.—This substance is of French origin, and its manufacture is secured by patent. It was discovered by a French chemist; but that it is a substance easily manufactured may be inferred from the fact of its being shipped free on board for 35*s.* per ton. Mr. Joseph Owen of Copenhagen acquired the knowledge of the manufacture from the patentee in France, and has since established a manufactory on his own account in Copenhagen. His traveller, a Danish gentleman, was the first to introduce this new manure to the notice of the Scottish agriculturists. We have not had an opportunity of seeing a sample of it, but it seems it has been tried last year by Mr. Dalgairns of Ingliston, and Mr. Inches of Cardean, who, we hope, will favour us with their opinion of its efficacy. We understand that the Danish gentleman has disposed of 250 tons of it in the counties of Forfar and Kincardine. Mr. Owen's card gives the following account of its nature, and the mode of using it:—

"The chief excellency of this manure is, that it is powerful in its effects, occupies but little room, is easily separated, and conveniently used either by hand or drill; its effects are farther to ensure a rich crop, by gradually ameliorating the soil, and rendering fallowing unnecessary. For wheat, rye, buckwheat, barley, and similar descriptions of corn, about 8 cwt. 1 qr. 16 lb. is used per acre: it may be either broadcast or drilled in before harrowing. For flax, hemp, beet, potatoes, &c. about 10½ cwt. per acre; and 12 cwt. 2 qrs. 10 lb. per acre for artificial mea-

dows, different sorts of cabbage, rape, culinary plants, and for refreshing natural meadow land. For plants that are set in rows, a handful is put to each plant; for those which are transplanted, a child follows the planter, and thows a very small handful of the manure into each hole which is immediately covered over with earth:—in several places for rape, it is scattered out in rows, along the roots of the plant, which the plough covers by forming a new furrow. On meadow land it must be spread out in December or January, when the snow is not on the ground. Generally speaking, it is well to mix the manure with half its quantity of finely sifted earth; but there is no necessity for pursuing this method. On light and warm soils about 2 qrs. 22 lb. less per acre is used than on cold or clay lands, where an extra 2 qrs. 22 lb. are added to the quantity as beforehand directed to be used; it is in fact left to the farmer's judgment to make use of the above directions, according to local circumstances. What characterizes this manure most is, that it developes its effects so slowly and gradually, that it may be applied without danger in contact with the seed or roots of plants; in this it differs from a number of other manures which are less rich, but more heating. In Scotland it has been tried in 1834 on eight different soils, has been found nearly equal to bone-dust for turnips, and has since been ordered in large quantities from the manufacturer Mr. Owen at Copenhagen, who delivers it free on board at 35*s.* per ton."—*Quarterly Journal of Agriculture*, No. 28.

Parmesan Cheese.—The country between Cremona and Lodi comprises the richest part of the Milanese. The irrigation too is brought to the highest state of perfection. The grass is cut four times a-year as fodder for the cows, from whose milk is made the well known cheese called Parmesan. The cows which are kept in the stall nearly all the year round, are fed during summer on two of these crops of grass or clover, which are cut green, and in the winter on the other two, which are hayed. The milk of at least fifty cows is required for the manufacture of a Parmesan cheese. Hence, as one farm rarely affords pasture for such a number, it is usual for the farmers or metayers of a district to club together. The milk of 50, 60, or even 100 cows, is brought twice to the farm where the dairy is fixed; the person on whom devolves the task of making the cheese, keeps an account of the milk received, and the cheese is afterwards apportioned accordingly. In this fertile plain a farm of sixty acres is considered as a large one. These farms are sub-divided into fields of three or four acres, for the convenience of irrigation; a practice which, in the course of a few years impairs the quality of the grass to such a degree, that it becomes necessary to discontinue it. In this case, the sluices of the Gora are shut, the ground is ploughed in autumn, and in the following spring sown with hemp, which shoots up to a great height; when this is pulled, the ground is sown with leguminous plants. In the next spring it is sown with oats, which grow to the height of one to seven feet. The richness of the soil being thus sufficiently subdued, it is next cropped with wheat. Maize is then sown in the following spring; a second crop of wheat succeeds, and finishes the course of cropping. The ground is then left to itself, and is immediately covered with herbage. During winter it is manured, and the new meadow is then subjected again to the process of irrigation, which is usually continued for fifteen years. Thus the rotation in the Milanese extends to twenty years; five years for the growth of hemp,

pulse, and grain, and fifteen for the growth of grass. Rice is also grown in some parts of the Milanese; but as it partakes of the nature of an aquatic plant, for the rice grounds are kept under water during nearly the whole period of its growth, its cultivation has been placed under considerable restriction by the government, owing to the malaria which it engenders. —*Evans' Italy.*

Scarlet Trefoil, Trifolium incarnatum.—It is well known that all the clovers like a solid bottom, and from experience it appears, that such is more particularly the case with the scarlet trefoil. When the land on which it has been sown has been rendered fine and light by repeated ploughings, the crop has frequently been an entire failure, and I have never heard of a single instance of failure when the seed was committed to an unploughed surface. In the beginning of October 1833, I sowed a part of garden-ground, the soil being strong and rich, upon a chalk bottom; the seedlings came up well, but in the course of the winter all perished with the exception of a single plant. In September Colonel Beach sowed a few acres in a field about a hundred yards distant, which he had ploughed and dressed for the purpose, the soil being in this case of a similar nature to that mentioned above, and here, again, the crop was a failure. At a distance of about two hundred yards, and upon soil precisely similar, and in the same season, a still unploughed wheat stubble, produced as fine a crop as could be desired. The farmer who had this crop had previously pursued the same plan, and had realized from his produce upwards of 40*l*. per acre. I find also that the crop has frequently failed in the county of Essex, where the ground had been ploughed before sowing. In September last I sowed 4½ acres upon a barley-stubble, without any preparation whatever, and there is abundance of plants. I do not mean to assert positively that no crop will follow after ploughing, but experience proves, that where this is done, success is very doubtful. With respect to the properties of the trefoil, I do not believe that there is a more hearty green food in existence. Cattle are extremely fond of it. Farm-horses, during their spring-work, may be kept in the highest condition on it, and after affording abundant food, it may be cleared off in time for turnips, which, upon trial, have succeeded perfectly well after the trefoil. Scarifying the ground has been found to answer well, and where the surface is foul, it is certainly advantageous. —*British Farmer's Magazine, April* 1835

Consumption of Staple Articles in England.—The following is an accurate estimate of the home consumption of England in the great staple articles of commerce and manufactures. Of wheat fifteen million quarters are annually consumed in Great Britain; this is about a quarter of wheat to each individual. Of malt twenty-five million bushels are annually used in breweries and distilleries in the United Kingdom, and there are forty-six thousand acres under cultivation with hops. Of the quantity of potatoes, and other vegetables consumed, we have no accounts. Of meat about one million two hundred and fifty thousand head of cattle, sheep, and pigs are sold during the year in Smithfield market alone, which is probably about a tenth of the consumption of the whole kingdom. The quantity of tea consumed in the United Kingdom, is about thirty million pounds annually. Of sugar nearly four million hundred-weights, which is a consumption of twenty pounds for every individual, reckoning the population at twenty-five millions: and of coffee about twenty million pounds are annually consumed. Of soap

one hundred and fourteen million pounds are consumed: and of candles about a hundred and seventeen million pounds. Of clothing we annually manufacture about two hundred million pounds of cotton wool, which produces twelve hundred million yards of calico and various other cotton fabrics, and of these we export about a third, so that eight hundred million yards remain for home consumption, being about thirty-two yards annually for each person; the woollen manufacture consumes about thirty million pounds of wool.

GARDENING.

Culture of the Oxalis Crenata.—The manner of culture very much resembles that of the potato, with this exception, the tubers should not be planted whole, if so, the plant grows strong and diffuse, causing an abundant growth of offsets from the roots, which impoverishes the plant, and extracts the necessary nourishment assigned to the formation of the tubers. The tuber should be cut in sets, the same as is done with potatoes and planted out in the first week in April, in drills running North and South, two feet and a half distance from each other, and the sets two feet asunder. Manure or rich ground is not required: the poorer the soil the better, as they will be very luxuriant the first five or six years. Prepare the ground by digging it deep and breaking it fine; lay the set at the above specified distance, flat on the surface of the ground, and cover it two inches thick with fine dry sand; from this the process is the same as with potatoes: earth up with poor, dry earth, mixed with lime rubbish, such as Sorrel of every species seems to flourish in. As soon as the blossoms have all fallen off, it is necessary to check the growth of the plants, in order to promote the swelling of the tubers. This is performed by taking the stems in the hands, turning them gently round two or three times, and fastening them in this position with bits of branches to keep them off the ground for fear of rotting, as well as to keep them from breaking, in case of high winds. At present, they are not an early vegetable, but will become earlier in the course of five or six years. As soon as the stems begin to decay, they are fit to dig, and should be put by for use in some dry shed, and covered with straw or mats to keep the wind from them. The best way to cook them is, to put them into boiling water; and when they become a little soft, pour off the water and place some hot cinders near the lid of the saucepan, which will throughly do them, rendering them dry and mealy. The opinion of the writer is, that they will soon become a very useful vegetable, but he does not agree, that they will supersede the potato.*

Product of six plants	4lbs.	8oz.
Weight of largest Tuber	0	1
Weight of twelve largest Tubers	0	8

* This observation, that the O. crenata, is not likely to supersede the potato is a very just one. 1,920 grains of the root were ground up, and the farina carefully extracted; the produce was only 30 grains, while that from the same quantity of tolerably good potatoes amounted to 240 grains. This will show its inferiority as an article of food, as compared with the potato.—*Irish Farmer's and Gardener's Magazine.*

Simple and expeditious Modes of ascertaining the Heights of Trees.— We intend at present, to speak only of measuring trees for the purpose of ascertaining their heights, and the diameters of their trunks at a foot from the ground.

Trees are either crowded together, or stand singly, or so as to be clear from other trees on at least one side. In the former case, they are best measured by sending up jointed rods, formed of deal, or any other light wood. First one rod (say 5 ft. or 10 ft. in length, and half an inch in diameter) is pushed up the side of the trunk, and held there by the left hand; and a piece of tin tube, about 4 in. in length, and of the same diameter in the clear, as the rod is put on the lower end of it about 2 in. One end of this tube being firm on the rod which is held up alongside the trunk, with the left hand, insert another rod in the other end of the tube with the right hand, and so on, till you have pushed the jointed rod so formed to the top of the tree. Then take it down, and count the number of rods, &c., putting each piece of tin tube, as it is taken off, in your pocket. This may seem a tedious operation; but a man and a boy, with 15 rods, and 14 pieces of tin tubing, will measure more than 100 trees in a day.

When trees either stand singly, or are open on one or more sides, their heights are taken with the greatest accuracy and expedition by looking up to them at an angle of 45°; or, in other words, placing the tree in the side of an imaginary square, and looking at it along the diagonal line of that square. A square for this purpose any gardener may form for himself out of a piece of pastboard, or a thin deal board: he may either form the square, and cut it off from a board; or he may form it on the end of a board having a straight edge, as in the cut. In either case, a line and plummet must be suspended from one angle of the

square; and the operator has only to place himself at such a distance from the tree, that, when he sees the top of it, the line may be exactly in the direction of the diagonal of the square, as in the figure. It would be a waste of words to explain what must be perfectly obvious by mere inspection of the figure, even to those who have not (like most gardeners) acquired a smattering of geometry; viz. that the line *a b* is equal in length to the line *b c*; and that the correct height of the tree will be obtained by adding to it the height of the operator's eye from the ground, and half the diameter of the trunk of the tree at the ground's surface; in other words, by adding to the line *a b*, the line *a d* or *d e* (which are both of the same length as *b f*), as also half the diameter of the tree, or the line *f g*. This is an operation which we have seen an expert practitioner perform in two minutes; but we may allow, at an average, ten minutes to each tree.

The height of single trees may also be taken with expedition during bright sunshine by their shadows. Set up a rod, say of 6 ft. in height above the surface, and measure its shadow; then measure the tree's shadow, and find the height by the Rule of Three.

For both the last modes the tree must stand on level ground, otherwise additional observations must be taken, which it would occupy too much space to explain here. When single trees are on a sloping bank, their height may be taken by the square, by looking at them across the slope, that is, by looking at them on a horizontal plane. By rods, of course, their height may always be taken in whatever way they are situated.

The diameter of the trunk of a tree may be readily taken by girting the tree with a string, one third of the length of which will give the diameter; or the tree may be measured with a rod, having a piece fixed to it at right angles at one end, and a sliding piece like a shoemaker's measuring rule. An ingenious instrument of this sort has been invented by Mr. Blackadder of Glammis, in Forfarshire; and it has been in use by him many years.—*Gardener's Magazine*, No. 67.

Wasps.—The dry sultry weather in the early part of last summer led to the increase of wasps, and the fruit in many places was considerably damaged by them. On the estate of the Countess of Bridgewater, near Hemel Hempstead, *two thousand eight hundred* nests were destroyed, for which sixpence per nest was paid, amounting to *seventy pounds!*

To destroy Insects by a Solution of Chlorine is said to be a cheap, clean, and easy method. Mr. H. Hall, in the May number of the *Irish Farmer's and Gardener's Magazine*, says he has employed this solution for the last three years. It is "made by mixing with twenty gallons of spring water a pound of the chloride of line (or common bleaching powder), in a large jar, which can be easily made air-tight: to this add about a pound of sulphuric acid (vitrol), which disengages the chloride, and, uniting with the lime, precipitates it in the form of sulphate, leaving a clear solution of chlorine."

Lepidium ruderale is a complete antidote to bugs. Hang up a bunch in a chamber, and they will flock to it, and in a short time be killed by its odour.—*Tournel's Fauna of the Moselle, as quoted in the Printing Machine.*

A Mode of protecting Wall Fruit Trees is now exhibited in the Horti-

cultural Society's Garden at Chiswick, which deserves the attention of every kitchen gardener: it is simply that of stretching straw ropes in front of the trees, the lowest about 4 feet from the ground, and about 2 feet from the wall; and the highest a few inches under the coping, and from 6 inches to 1 foot from the wall. The intermediate ropes are about 2 feet apart. The ropes are kept at regular distances from each other and from the wall, by being tied to cords; one end of each of which is fastened to the nail or hook driven in under the coping, and the other to a stake driven into the ground about 4 feet from the wall. In this way the lines serve as rafters, and the angles formed by the lines with the perpendicular of the wall being about 15 deg., the rough straw ropes, though 2 feet apart in the direction of the slope, are not above 6 inches apart measured horizontally. It is in consequence of this closeness horizontally that they protect the trees, by preventing the perpendicular radiation of the heat from the surface of the ground; and it is in consequence of their distance vertically that they do not injure the blossoms by shading them from the sun. It is clear, from the trial in the Horticultural Society's Garden, that these ropes are just as effective in protecting the trees as netting or bunting; and, as the cost is so very much less, especially in the country, where coarse wheat straw or litter is abundant, no gardener who is allowed hands sufficient to do the work of his garden need ever have his wall trees injured by frost.—*Gardener's Magazine, No.* 62.

Agave Americana.—At Bute House, the Villa of the Right Honourable Viscountess Dillon, at Old Brompton, there is (August 1835) one of these splendid and rarely flowering exotics in full bloom. The flower stem is rising towards fifteen feet high, surmounted by a fine branched head of flowers. Her Ladyship has been at the expense of erecting a canvass covered frame to shade, and thereby preserve its beauty as long as possible. Mr. Briant, her Ladyship's gardener, states that, he is uncertain as to the age of the plant, but has traced its history for at least forty years back. It is a plant of the striped variety, which we believe never arrives at so great bulk before flowering as the common unvariegated sort. The large substantial leaves which have so long involved and now surround the stem, seem as if they were solely intended as reservoirs of the nutriment required for the developement of the fructification; because already the lower leaves have lost their plump rigidity, and become flaccid and drooping; and by the time the flowers are expanded, the whole of this division of the plant will inevitably perish, except perhaps a sucker or two which may rise from the root. This decay immediately after the maturation of seed or developement of the head of flowers, happens in consequence of the peculiar structure of the genus, and which separates it so completely from the genus *Aloe*, with which it is often associated, and whose name it most frequently bears. The aloes, however, produce their flowers laterally, that is, from the axils of leaves; whereas those of the *Agave* are terminal, that is, placed on the point of the axis of the plant. There are several other plants constituted in the same way. Some of the Palms are purely *individual;* but the most familiar example is the common house-leek, which though constitutionally like the agave, is neither ranged with it in the same natural order, nor yet in the same class of the sexual system.—*Horticultural Register, No.* 50.

Another noble specimen of the variegated variety of the great American Aloe has lately bloomed at the Surrey Zoological Gardens. It is be-

lieved to be about 70 years old. The crown of the plant opened on the 8th of June, and the flower-stem grew at the rate of about four inches a day.

The Rohan Potato, a new variety.—The following is an extract from a letter written from Geneva, of date 25th of April 1834, by Prince Charles de Rohan to M. Jacquemot-Bonnefont, Nurseryman, Annonay, in the Ardeche.

I send you, through my friend M. Romilly, the potato which I promised you; and to which my name has been given in this country. The history of this potato is not le[ss sing]ular than the potato itself. He who obtained it from seed four years ago shows it, but will not give it to any person: he has refused it to King William. He has cultivated it in a little walled inclosure: he only wishes to see it in perfection, and the seed of the following year. He makes them to be taken up in his presence; keeps them under lock and key, and to be cooked for himself and cattle before his face. It is at great risk that I have been able to procure two tubers. This exclusive amateur having learnt that I had got some *cactuses*, which he wished much to have, begged me to give him some. I wished no money, but very much to have some of his wonderful potato. He gave me two of them, and made me give my word of honour that I would never send any of them to Holland, Belgium, England, Prussia, or Germany. Happily he has not thought of Switzerland nor France; for without this omission, I could not have had the pleasure of offering these to you.

This is the mode of cultivating this potato:—The earth is dug to the depth of twenty inches; make the distance between the holes four feet, and put two or three eyes, or sets, in each hole. Earth up frequently. The stalks, reaching six or seven feet in height, must be supported on transverse stakes. The kind being late, the tubers, which are very farinaceous, should only be taken up about Martinmas, when the stalks wither.

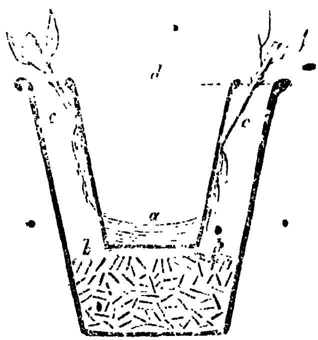
To give you an idea of the extraordinary produce of this potato, I give three examples at random. M. E. Martial, at Alais, gathered last autumn tubers weighing 13 lb. 7 oz., 11 lb. 9 oz., and 9 lb. 13 oz. M. de Montet, a proprietor near me, asked me for tubers when I could not give him more than a single small tuber having four eyes. He weighed it for curiosity, and found that it wanted a few grains to make half an ounce. However, this small tuber being planted, produced 48¼ lb. The Attorney of the Abby of Auterive, canton of Fribourg, to whom I had given two tubers two years ago, and who, delighted with his first harvest, after having eaten and given some to his friends, planted the rest, and obtained last autumn six double horse loads and eight scuttle fulls. It is not the largest tubers which succeed best as seed.—*Le Cultivateur, Journal des Progres Agricoles, Jan.* 1835.

Nursery at Algiers.—A nursery ground has been formed at Algiers, with a view of naturalizing such trees as flourish in climates not much dissimilar to that part of Africa. It now contains 13,000 mulberry trees, and 5,000 young plants; 7,400 olive plants, 1,164 varieties of fruit trees, a plantation of sugar canes, and plants of the indigo, cotton, and New Zealand flax, as well as a great number of trees and shrubs of South America and India.—*Printing Machine.*

Faulkner's New Scarlet Pine.—A remarkably productive and fine-flavoured strawberry has been raised by Mr. Faulkner, of the Flora Tea Gardens, Battersea Fields. It is of a particularly fine clear colour, high

flavour, and in productiveness, judging from the produce of a single plant which was brought to us, we should say that it excels all others.—*Gardener's Magazine, No.* 66.

A New Method of Striking Cuttings, by Mr. Alexander Forsyth.—The sketch represents a new mode of striking cuttings, which I have proved to be far superior to the ordinary practice; and which is so extremely simple, that I think it is likely to be adopted, as well by the amateur cottage matron, with her pinks and wallflowers, as by the professed propagater of valuable exotics. It is as follows:—Take a wide-mouthed 48-sized pot, for example, and crock it in the usual manner with broken tiles, &c.; then take a wide-mouthed *small sixty*, and put a piece of clay in the bottom of it to stop the hole; then place it inside the other, on the top of the crocking, so that the brims of both pots may be on a level. Then fill in the space between the pots with sand, or other propagating soil, according to the nature of the plant about to be propagated; and let the cuttings be inserted in the manner here shown, with their lower extremities against the inner pot. Plunge the pot in a cutting-frame, or under a bell or hand-glass, in a shady place out of doors, according to the nature of the cuttings and the season of the year; and let the inner pot be filled and kept full of water.



The advantages to be derived from this method are numerous, and must be evident even to the casual observer; the principal of these are,—the regularity of the supply of moisture, without any chance of saturation; the power of examining the state of the cuttings at any time, without injuring them, by lifting out the inner pot; the superior drainage, so essential in propagating, by having such a thin layer of soil; the roots being placed so near the sides of both pots; and the facility with which the plants, when rooted, can be parted for potting off, by taking out the inner pot, and with a common table-knife, or the like, cutting out every plant with its ball, without the awkward, but often necessary, process of turning the pot upside down to get out the cuttings.

In the cut, *a* shows the clay stopping of the pot; *b*, the drainage of potsherds, or broken crocks; *c*, the sand or other soil in which the cuttings are inserted; and *d*, the water in the inner pot.—*Gardener's Magazine, No.* 68.

Ink for writing on Zinc Labels.—Reduce equal parts of verdigris and sal-ammoniac to powder; add a fourth part of lampblack, and five parts of water. Mix the composition well in a stone mortar; add the water gradually, and take care to shake the composition before it is used.

Hop Branches a substitute for Flax.—After the hops are picked, cut the branches into strips of about three or four yards long, expose them to macerate in the dew for a few nights, then put them in running water, and afterwards dry them in the air. After this they must be crushed, and treated in the same manner as flax.—*Annales des Arts et Manufactures.*—The experiment is stated to have succeeded perfectly in France.

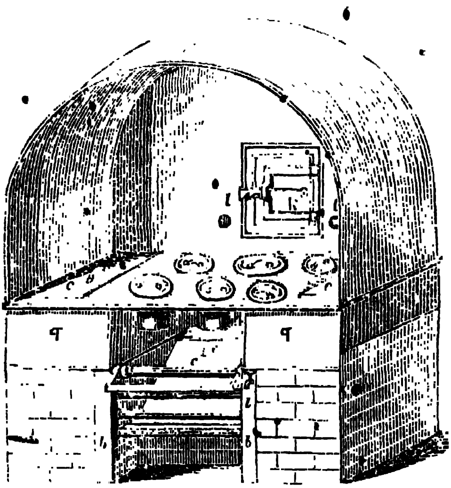
DOMESTIC ECONOMY.

Weeks's patent Cooking Apparatus.—Mr. Weeks's improvement in the cooking range consists in taking the greatest possible advantage of a given quantity of fuel, so as to obtain the greatest extent of heated surface from the means allowed. To attain this end, the front bars of the grate, the cheeks, the back, and the end pieces into which the back fits, are constructed of hollow tubes, the whole having at the same time the appearance of a common grate; and pipes from these communicate with two hot water cisterns, one placed on each hob of the grate. There is also a communication between these cisterns by pipes passing horizontally over the back of the fire-place, so that a continually circulating medium is obtained.

There is an oven connected with the improved range, in which, from the manner of its construction, meat may be baked, and yet have all the advantage of meat that is roasted.

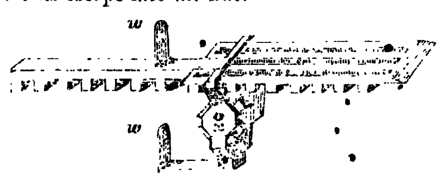
The writer then proceeds to describe and illustrate, by engravings, four different varieties of Mr. Weeks's apparatus:—1st, "a tradesman's kitchen-range;" 2nd, "a cottager's or poor man's cooking range;" 3rd "a kitchen range, or cooking apparatus suitable for a gentleman's family;" and 4th, "a range suitable for a hotel or club-house, or confectioner's."

The third of t[illegible]es is that which exhibits the apparatus in its completest form th[illegible]ving of it is prefixed to the present abstract, and the followin[illegible] are the [illegible]scriptive details:—



The front bars (*a a*), which are hollow, communicate with hollow, cheeks (*b b*), from the back of which pipes pass to the bottom of the cisterns (*c c*); and the communication between the cisterns is formed by the pipes (*d d*). The back of the grate, which is composed of hollow tubes, fits into hollow end pieces, each of which has also a pipe to communicate with the hot water cisterns (*c c*). The inside of the cast iron back of the grate, which the poker comes against in poking the fire, is nearly smooth, and th[illegible] pipes are almost entirely on the outside. The surface of the range [illegible] covered with a cast iron plate, in which are placed five cast iron pans and a fish kettle (of course the number of these pans may be increased), for stewing and for other culinary purposes. These

vessels contain only boiling water, but tin vessels are placed in them, and in the cisterns containing water, the articles to be cooked either by stewing or boiling; the water, &c. in the inner vessels being made to boil by those vessels being surrounded by the boiling water in the outer vessels. This offers two advantages, namely, that the water in the tin vessels can never exceed the boiling point, and that these vessels, with their contents, may be easily and at once lifted out. There are two sheets of cast iron (*q q*) which slide in grooves, and are pushed together to keep the fire and heat from any one engaged at the stew pans. The cock (*i*) for drawing the water off is fixed near the top of the range, so that the pipes can never be wholly emptied. Above the cast iron plate and pans is the oven. This is double cased, so that there is a vacuity all round, except at the doorway, for a current of hot air. But the principal improvement here consists in the introduction of a continual current of air. We all know that meat which is roasted is superior to meat that is baked, because the former is cooked in a continually changing, and consequently a purer atmosphere; and the exhalations from it pass up the chimney and otherwise into the atmosphere; but the meat that is confined in an oven becomes saturated with the impurities with which the air surrounding it has become contaminated. To obviate this evil, openings (*l l*) are made on each side of the oven, through which a constant current of air passes, and the exhalations are thus carried up by a funnel into the flue. From the cisterns on each side a pipe may be carried through the wall behind; this pipe will carry boiling water to a very considerable distance; so that by having another cistern beyond the wall, cooking may be performed by the mistress or housekeeper in a different room from that where the fire is, and whence the boiling water is supplied. Over the range there is a canopy of tin or zinc, to prevent the steam ascending to the ceiling, at the top of which there is an opening for its escape into the flue.



It is well-known that a false bottom to a grate causes a great saving in fuel, because the fire is by it brought in closer contact with the bottom of the pots or pans placed on the grate; but at times when roasting is to be done, the whole depth of the grate is required. In order to save the waste of fuel occasioned by neglecting to put in the false bottom when no roasting is wanted, and to obviate the inconvenience of having the fire deranged when roasting is required, Mr. Weeks's plan of a false bottom will be effectual. The cut shows a false bottom connected with the grate; *w w* are screwed on to the cheek; and by turning round the handle, which is put on the axle (*x*) of the wheel, the false bottom, which has a thin edge, will make its way forward through the fire, and may be drawn back at pleasure. The thin edge, when pushed forward, rests in a groove on the other end of the grate.

MISCELLANIES.

LIST OF PATENTS SEALED IN 1835.

Navigation.—T. Smith, of Princes-street, Haymarket, engineer, for a new, standing rigging for ships and vessels, and a new method of fitting and using it. Jan. 12.

Piano-fortes.—J. Stuart, George-street, Eusten-square, for improvements on the mechanism of horizontal, grand, and square piano-fortes. —Jan. 15.

Dressing Hemp.—A. Shanks, jun., flax-spinner, Arbroath, Forfar, for improvements in machinery for preparing and dressing hemp.—Jan. 15.

Bedsteads.—J. Cherry, of Coventry, for improvements on bedsteads. —Jan. 15.

Type-founding.—W. Houston, of Fleet-street, printer, for certain improvements in type-founding.—Jan. 17.

Lace-making.—J. Streets, the younger, lace-manufacturer, and T. Whiteley, mechanic, both of Nottingham, for improvements in warp-machinery.—Jan. 22.

Urns.—J. J. Tucker, of Trematon-hall, Cornwall, Esq., for improvements on urns.—Jan. 22.

Railways.—J. Day, of York-terrace, Peckham, for an improvement in the construction of railways.—Jan. 22.

Urns.—W. E. Wright, of Regent-street, Westminster, Gent., for improvements in tea and coffee urns and tea-kettles.—Jan. 27.

Cutting machinery.—J. Gibbs, of Kennington, Surrey, and J. Gatley, of Whitechapel, Middlesex, engineers, for improvements in machinery for cutting wood, and other materials.—Jan. 27.

Steam engines.—W. Morgan, of the Kent-road, Surrey, Esq., for improvements in steam-engines.—Jan. 27.

Block-printing.—J. Budd, of Liverpool, Lancaster, merchant, for improvements in printing silk, cotton, calico, or other fabrics, and in the manufacture of blocks, cylinders, or rollers, used for such purposes.—Jan. 27.

Cutting machinery.—I. Dodd, of Horsely Iron-works, Tipton, Stafford, engineer, for improvements in machinery for cutting and shaping wood, and other materials.—Jan. 29.

Beds.—E. and J. Cook, of Birmingham, brass-founders, for improvements in beds and mattresses.—Jan. 31.

Diving Apparatus.—J. Bethell, of Mecklenburg-square, Middlesex, Gent., for improvements in apparatus for diving and working under water, and inspecting from above, objects which are beneath the surface of the water.—Jan. 31.

Masts and Piles.—T. Roberts, of his Majesty's Dock-yard, Plymouth, master-shipwright, for an improved mode of joining pieces of timber together end to end, applicable to the purposes of making the masts and top-masts of ships, also for making piles, and for certain other purposes wherein timber is required to be lengthened.—Feb. 6.

Pens.—C. Cleveland, of Falcon-square, London, clerk, for improvements on pens, on penholders, on apparatus for the supplying of ink to pens, and on apparatus for the making of pens.—Feb. 9

Paddle-wheel.—J. Halstead, of Burr-street, St. Catherine's, Middle-

sex, sail-maker, for a new and improved paddle-wheel for steam-vessels or mill-machinery.—Feb. 9.

Water and Paddle Wheels.—J. Leeming, of Manchester, Lancaster, worsted-spinner, for improvements in the construction of water-wheels and of paddle-wheels.—Feb. 9.

Printing machinery.—R. Hill, of Tottenham, Middlesex, gent., for improvements in letter-press printing by machinery.—Feb. 12.

Printing machinery.—E. Norris, of Walworth, Surrey, gent., for an improved machine for letter-press printing.—Feb. 12.

Bobbin-net.—T. Alcock, of Claines, Worcester, lace-manufacturer, for improvements upon machinery for making bobbin-net lace, being further extensions of certain improvements for which letters patent were granted to him on the 8th of December, 1832.—Feb. 12.

Flooring.—J. Hendry, of Wormwood-street, London, surveyor, for an improved method in laying, or a new combination in the construction of, floors in buildings.—Feb. 16.

Railways.—J. Price, of Gateshead, Durham, flint-glass-manufacturer, for improvements in railways, and in the means of transporting carriages from one level to another.—Feb. 16.

Buttons.—S. Burrell, of Birmingham, Warwick, manufacturer of gilt toys, for an improved method of manufacturing buttons for clothes.—Feb. 16.

Nail-making.—S. Slocum, of the New-road, St. Pancras, Middlesex, engineer, for improvements in machinery for making nails.—Feb. 16.

Flax-spinning.—J. Kay, Pendleton, Lancaster, flax-spinner, for a heckling-machine of a new construction.—Feb. 24.

Taps.—J. H. Hallett, Haven Cliff, Devon, for an improvement in the construction of cocks or taps, for drawing off fluids.—Feb. 25.

Carriages.—W. Aitken, of Aberdeen, for improvements in the construction of carriages.—Feb. 25.

Carriages.—P. S. Hynes, of Paddington, for improvements in wheels, axle-trees, and boxes, and in an apparatus for retarding or locking carriage-wheels.—Feb. 25.

Steam-engines.—J. Aldous, Clapton, smith, for improvements on steam-engines.—Feb. 25.

Substitute for Flax.—W. Newton, Chancery-lane, civil engineer, for improvements in preparing fibrous or textile plants, either indigenous or exotic, to be used in place of flax or hemp, being a communication from a foreigner residing abroad.—Feb. 25.

Nail-making.—R. Prosser, Aston, near Birmingham, civil engineer, for improvements in making nails.—Feb. 25.

Dressing Cloths.—W. Davis, Leeds, engineer, for an improvement in machinery for dressing of woollen and other cloths.—Feb. 25.

Steam-engine.—J. T. Beale, of Church-lane, Whitechapel, engineer, for a simplified and economical steam-engine.—Feb 27.

Bobbin net.—J. Levers and J. Pedder, New Radford, Nottingham, for improvements in machinery for making bobbin-net lace.—Feb. 27.

Piano-fortes.—F. L. H. Danchell, Great Marlborough-street, for improvements in piano-fortes, being partly a communication from his partner, F. G. Greiner, a foreigner, residing abroad.—Feb. 28.*

Piano-fortes.—R. Wolf, Cornhill, for an improvement in piano-fortes

* This patent being in litigation, was not sealed till Feb. 28; but it bears date the 1st Sept. 1834. By order of the Lord Chancellor.

consisting in the new construction on the principle of acoustics of a sounding body.—March 2.*

Railway Carriages.—T. F. Bergin, Fair-view Avenue, Dublin, for improvements in railway-carriages.—March 6.

Paper-making.—J. Prince, Bread-street, Cheapside, for an improved mould and apparatus to be used in making paper.—March 6.

Fermentation.—J. C. Sheridan, Walworth, chemist, for improvements in the processes of saccharine, vinous, and acetous fermentation.—March 9.

Dyeing.—H. Hendriks, Grove House, Blackheath, for improvements in dyeing.—March 11.

Steam Carriages.—J. B. Bacon, Sidmouth-street, Regent-square, for improvements in the construction of locomotive steam-carriages applicable to railways and common roads, being a communication from a foreigner residing abroad.—March 11.

Locomotion.—W. Hale, Colchester, civil engineer, for improvements on boilers or apparatus for producing motive power.—March 11.

Preserving Milk.—W. Newton, Chancery-lane, civil engineer, for a method of preparing animal milk, and bringing it into such a state as shall allow of its being preserved for any length of time with its nutritive properties, being a communication from a foreigner residing abroad.—March 11.

Table.—R. Jupe, New Bond-street, upholsterer, for an improved expanding table.—March 11.

Heat.—J. Sylvester, Great Russell-street, civil engineer, for improvements in apparatus used in the communication or transmission of heat to aeriform, liquid, and solid bodies.—March 11.

Carriage-wheels.—W. B. Adams, coach-maker, of Long-Acre, for an improved construction of wheels for all kinds of spring carriages.—March 13.

Locomotion.—W. Church, Heywood House, near Birmingham, for improvements in apparatus to be employed in the conveyance of goods and passengers by land or water, parts of which said improvements are also applicable to the ordinary purposes of steam-engines and other steam-apparatus.—March 16.

Locks.—R. Hill, Birmingham, for an improvement in door and other locks, and in staples used therewith.—March 18.

Printing Machinery.—A. Smith, of Belper, Derby, millwright and engineer, for an improvement in printing-machines.—March 18.

Dressing Stone.—J. Hunter, Ley's Mill, Arbroath, Forfar, for improvements in the art of cutting, or facing and dressing certain kinds of stone.—March 18.

Oils.—H. W. Wood, Austin Friars, London, for an improvement in obtaining certain oils, being a communication from a foreigner residing abroad.—March 18.

Cloth Machinery.—W. Weekes, King Stanley, Gloucester, clothier, for improved machinery in cleansing, plaining, polishing, and dressing woollen and other cloths.—March 25.

Umbrellas.—J. Barker, Southampton-street, Camberwell, for an improvement in the constructing of umbrellas and parasols.—March 25.

* This patent, with the preceding one, being in litigation, was not sealed till March 2; but it bears date the 6th Nov. By order of the Lord Chancellor.

Heddles.—J. Berrie and D. Anderson, Glasgow, for machinery for making a new or improved description of heddles or healds —March 25.

Gas-lighting.—J. Brunton, West Bromwich, Stafford, for improvements in the construction of retorts for generating gas for illumination. —March 25.

Printing Machinery.—W. Houstoun, Fleet-street, printer, for improvements in tools, implements, or apparatus for letter-press printing.— —March 25.

Steam-engines.—F. Humphrys, York-road, Lambeth, civil engineer, for improvements in marine and other steam-engines.—March 28.

Perpetual Motion.—P. A. de Chapeaurouge, Fenchurch-street, London, for a machine, engine, or apparatus for producing motive power, which he denominates a self-acting motive power, and is called, in France, by the inventer, Voland Moteur Perpetuel, being a communication from a foreigner residing abroad.—March 31.

Substitute for Soap.—J. Fenton, Sydenham, Kent, for a composition or material to be used as a substitute for soap.—April 3.

Lace-making.—H. W. Nunn, Newport, Isle of Wight, lace-manufac turer, for improvements in manufacturing the ornamental parts of lace.—April 3.

Trusses.—R. Gillespie, Piccadilly, Middlesex, for improvements on trusses, or in instruments for the cure of hernia or rapture, being a communication from a foreigner residing abroad.—April 3.

Wool-combing.—G. E. Donisthorpe, Leicester, and Henry Rawson, of the same place, hosier, for certain improvements in the combing of wool, and other fibrous substances.—April 3.

Axletrees.—J. Hardy, Wednesbury, Stafford, for improvements in the manufacturing of axletrees for carriages, and other cylindrical or conical shafts.—April 6.

Rotary Steam-engines.—M. Berry, Chancery-lane, for improvements in the construction of rotary steam-engines, being a communication from a foreigner residing abroad.—April 8.

Printing Machinery.—M. Berry, Chancery-lane, for improvements in the construction of printing machinery or presses, being a communication from a foreigner residing abroad.—April 9.

Gas-lighting.—H. E. Bacon, Christ-College, Cambridge, for an improved apparatus for regulating the flow of gas through pipes to gas-burners.—April 9.

Stop and Stopper.—S. Parker, Argyll-place, Regent-street, for an improved, metallic, air and water stop and stopper.—April 14.

Wheel and Axle.—J. Ingledew, Edward-street, Brighton, engineer, for an improved, metallic safety-wheel and revolving axle.—April 14.

Spinning.—J. Whitworth, Manchester, engineer, for improvements in machinery for spinning and doubling cotton, flax, wool, silk, and other fibrous substances.—April 14.

Axle grease.—H. Booth, Liverpool, for compositions of materials applicable for the greasing of the axle bearings of carriages, and machinery in general.—April 14.

Towing.—J. Boydell, jun., Dee Cottage, Chester, for improvements in machinery for tracking or towing boats and other vessels.—April 14.

Horse Shoes.—A. Stocher, Yeovil, Somerset, for improvements in machinery for manufacturing horse shoes and other articles.—April 14.

Pottery, Glass, &c.—G. Embrey, Lane Delph, Stoke-upon-Trent,

potter, for improvements in ornamenting china, glass, and earthenware.—April 14.

Woollen Cloth.—Sir J. Byerley, Whiteheads Grove, Chelsea, for a composition which will effect a considerable saving in oil and soap used in the woollen manufactories, being a communication from a foreigner residing abroad.—April 22.

Steam.—J. M'Curdy, Southampton-row, for an improvement or improvements for generating steam, being a communication from a foreigner residing abroad.—April 22.

Raising Vessels.—W. Kemp, Burslem, Stafford, for a machine for raising sunken vessels.—April 23.

Wool.—R. Earnshaw, Huddersfield, York, dyer and chemist, for improvements in preparing and working wool for making or manufacturing various fabrics.—April 25.

Cutting Machinery.—J. Stevenson, of Leith, merchant, and J. Ruthven, of Edinburgh, mechanician, for a method of cutting wood by certain improved instruments.—April 28.

Boilers.—C. W. R. Rickard, of Thistlegrove, Kensington, engineer, for improvements on boilers.—April 28.

Water-proof Fabrics.—W. S. Potter, of Verulam buildings, Middlesex, merchant, for improvements in rendering fabrics water-proof, being a communication from a foreigner residing abroad.—April 28.

Fire-arms.—J. S. Clerk, minister of Currie, county of Edinburgh, for improvements in the construction of guns or muskets, and other fire-arms.—April 28.

Fire-arms.—I. Dodds, of Horsley Iron-works, Stafford, engineer, for improvements in the construction of fire-arms.—April 30.

Railways.—J. Reynolds, of Oakwood, near Neath, Glamorgan, iron-master, for improvements in railways.—May 5.

Safety Drag.—W. Simpson, of Evesham, jobbing smith, for a safety drag or lever slide for carriages.—May 9.

Fire-arms.—J. Egg, of Piccadilly, gun-maker, for improvements in descriptions of fire-arms.—May 9.

Engraving.—A. H. J. F. Valois, of Lyons, in France, but now residing at No. 9, Artillery-place, Finsbury-square, gentleman, for improvements in the mode of producing engravings, etchings, or reliefs, on metallic plates (for producing impressions therefrom), and in the apparatus used in same.—May 13.

Manifold Writing.—T. Dunkin, of Bordeaux, in France, but now residing at No. 2, Trinity-place, Charing-cross, late officer in the 18th regiment of Hussars, for improvements in the mode of obtaining duplicate copies of manuscripts, writings, and drawings, and in the apparatus or machinery used in the same.—May 18.

Safes.—C. Chubb, of St. Paul's Churchyard, for improvements in the means of making secure strong doors, safes, chests, and boxes.—May 13.

Lace-making.—H. Dunington, of Nottingham, and W. Copestake, of Stapleford, Notts, for improvements in making lace.—May 13.

Cylinder Printing.—J. Buchanan, of Ramsbottom, Lancaster, for improvements in cylinder printing machines, used for printing paper, calico, and other fabrics.—May 13.

Piano-fortes.—P. F. Fischer, of Great Marlborough-street, Middlesex merchant, for improvements on piano-fortes, being a communication from a foreigner residing abroad.—May 13.

Water-closets.—J. Ody, of the Strand, Middlesex, patent truss-manufacturer, for an improved construction of water-closets.—May 13.

Iron manufacture.—C. Schafhault, of 77, Cannon-street, London; gentleman, for an improvement in manufacturing malleable iron.—May 13.

Gas apparatus.—A. Dumoulin, of Leicester-square, merchant, for improvements in gas-apparatus.—May 19.

Tanning.—W. Patterson, of Dublin, gentleman, for a new material for tanning hides and skins.—May 20.

Carriages.—T. F. Bergin, of Fair View Avenue, Dublin, civil engineer, for improvements in the method of suspending and adjusting the bodies of railway and all other wheeled carriages.—May 27.

Spinning.—J. G. Bodmer, of Bolton-le-Moors, Lancaster, civil engineer, for improvements in machinery for preparing, roving, and spinning cotton and wool.—May 27.

Surface-printing.—J. Losh, of 8, Crescent, Carlisle, for an improvement in the surface or pattern roll of the machines used in printing callico and other goods, commonly called a surface-printing machine, and in the mode of working the said rolls.—May 30.

Pumps.—J. Nye, of St. Andrew's-road, Southwark, for improvements in pumps and apparatus for conveying fluids into, and withdrawing them from, cavities of human and other animal bodies.—June 2.

Gas-lighting.—J. Malam, of Kingston-upon-Hull, civil engineer, for improvements in gas-meters, and in the apparatus for generating gas for illumination.—June 2.

Steam Navigation.—W. Wilkinson, of Lucas-street, Commercial-road, engineer, for improvements in the machinery, by which steam-power is applied to give motion to ships or other floating vessels.—June 2.

Sulphate of Soda.—R. Phillips, of New Kent-road, Surrey, for his improvements in the process of manufacturing sulphate of soda.—June 4.

Soap.—J. Leman, of Lincoln's-inn-fields, gent., for the making, or improving soap, being a communication from a foreigner residing abroad.—June 4.

Calico Printing.—B. Woodcroft, of Ardwick, Lancaster, gent., for improvements in printing calicos and other fabrics.—June 4.

Caoutchouc Fabrics.—T. Hancock, of Goswell street-road, water-proof-cloth manufacturer, for improvements in air beds, cushions, and other articles manufactured from caoutchouc or Indian-rubber, or of cloth or other flexible materials, coated or lined with caoutchouc or Indian-rubber.—June 4.

Turning, &c.—J. Whitworth, of Manchester, machinist, for improvements in machinery, for turning, boring, planing, and cutting metals, and other materials.—June. 11.

Gas Lighting.—E. Carter, of Exeter, for an improved apparatus for regulating the supply of gas to the burners, and for the stopping off the same.—June 22.

Subaqueous apparatus.—J. W. Fraser, of Ludgate-hill, for improvements in apparatus for descending under water.—June 22.

Smelting.—J. Mitchell, of Truro, Cornwall, for an improved process in smelting argentiferous ores.—June 22.

Bobbin Net.—W. Crofts, of New Radford, machine-maker, for improvements in machinery for making figured or ornamented bobbin-net, part of which improvements are extensions of certain improvements for which Letters Patent have been granted to him, bearing date the 27th day of May, 1834.—June 26.

Candle Extinguishers.—T. Walker, of Burslem, mechanic, for improvements in extinguishers to candles.—July 3.

Spinning.—J. Kean, of Johnston, Renfrew, engineer, for an improved throstle-flyer, or a substitute for an ordinary flyer, employed in spinning cotton, flax, hemp, wool, silk, &c.—July 3.

Paddle Wheels.—H. Vint, of Lenden, Colchester, Esq., for certain improvements in paddle-wheels.—July 9.

Smoke-consuming.—R. Coad, of Liverpool, manufacturing chemist, for improvements in the apparatus for consuming smoke and economizing fuel in furnaces. July 10.

Propelling Boats.—W. Busk, of Bankside, Surrey, engineer, for improvements in propelling boats, ships, or other floating bodies.—July 10.

Paddle Wheels.—J. Rogers, of Princes-court, Westminster, gent., for improvements in paddle-wheels.—July 10.

Weighing Machines.—C. G. Kuppler, of Nuremburg, but now of Birmingham, for improvements in the construction of weighing machines.—July 11.

Propelling.—F. H. Maberly, of Bourn, Cambridge, clerk, for a new method of propelling vessels.—July 13.

Spinning.—J. Cheeseborough Dyer, of Manchester, machine-maker, and James Smith, of Dunstone, Perth, cotton-spinner, for improvements in machinery for winding upon spools, bobbins, or barrels, slivers or rovings of cotton, wool, and other fibrous substances.—July 17.

Files.—W. Vichers, of Sheffield, merchant, for improvements in machinery, for preparing or shaping steel for the manufacture of files and rasps.—July 17.

Disinfecting.—J. H. Jerome Poittevin, of Craven-street, Middlesex, gent., for a powder to disinfect night soil, and facilitating the producting of manure, being a communication from a foreigner residing abroad.—July 17.

Paper-making.—J. Dickinson, of Bedford-row, Holborn, and W. Long Tyers, of Apsley Mill, of King's Langley, Hertford, for improvements in the manufacture of paper. July 24.

Hinges.—T. Horne, of Aston near Birmingham, brass-founder, for improvements in the manufacture of hinges.—July 24.

Gas lighting.—H. B. Chaussenot, of Leicester-square, civil engineer, for an improved construction of the lamps or apparatus for burning gas, —July 28.

Looms.—S. R. Anderson, of Cornhill, Esq., for improvements in hand and power looms.—July 28.

Finishing Woven Goods.—R. and A. Charlton, of Manchester, for improvements in the machinery for stiffening and finishing woven or manufactured goods.—July 28.

Bobbin Net.—W. Crofts, of New Radford, Nottingham, machine-maker, for improvements in machinery for making figured or ornamented bobbin net; which improvements are in part in extension of part of the improvements for which letters patent were granted to him on Dec. 23, 1834.—July 30.

Fire-arms.—W. Mason, of Brecknock-terrace, Camden-town, Middlesex, engineer, for improvements in the manufacture of fire-arms and artillery.—Aug. 6.

Steam Engines.—W. Mason, of Brecknock-terrace, Camden-town,

Middlesex, engineer, for improvements in steam engine cylinders, pistons, bearings, pumps, and cocks.—Aug. 6.

Cotton-Spinning.—S. Faulkner, of Manchester, cotton-spinner, for an improvement in the construction of a machine for carding cotton and other fibrous substances.—Aug. 6.

Ventilation and Combustion.—J. C. Douglas, of Great Ormond-street, Middlesex, Esq., for improvements in ventilating subterraneous and other places, and in constructing apparatus in which combustion is carried on, and also in applying certain fluids to various useful purposes.—Aug. 10.

Brick Machinery.—E. Jones, of Birmingham, builder and brick-maker, for improvements in machinery for moulding bricks, tiles, and other articles of brick earth.—Aug. 10.

Condensing Steam-Engines.—S. W. Nicholl, of Elham, near Canterbury, gent., for improvements in rendering condensing steam engines portable and applicable as a means of general transport on rail and other roads.—Aug. 10.

Flour Mills.—L. Hebert, of Paternoster-row, London, civil engineer, for improvements in flour mills.—Aug. 10.

Coal-box.—W. E. Wright, of Regent-street, Westminster, gent., for an improved box for holding coals.—Aug. 12.

Carriage-wheel.—J. Day, of York-terrace, Peckham, gent., for an improved wheel for carriages.—Aug. 14.

Roof-ties.—R. Sheppard, of Newport Pagnell, carpenter and builder, for improvements in ties for covering of roofs.—Aug. 17.

Silk Manufacture.—T. R. Shute, of Watford, silk-throwster, for improvements in spinning and doubling organzine silk.—Aug. 17.

Animal Charcoal.—F. Bowman, of Great Alie-street, Middlesex, sugar-refiner, for an improvement in the process of renewing the virtues of animal charcoal, being a communication from a foreigner residing abroad.—Aug. 17.

Gas-lighting.—H. Phillips, of Exeter, chemist, for improvements in purifying gas for illumination.—Aug. 17.

Ruling and Pressing Paper.—W. Banks, of Spring-hill-terrace, near Birmingham, manufacturer, for improvement in machinery, pens, and presses, for ruling and pressing paper.—Aug. 17.

Inland Transit.—H. Pinkus, late of Pennsylvania, in the United States of America, but now of 76, Oxford-street, Middlesex, gent., for improvements in inland transit; which improvements are applicable to, and may be combined with, an improved method of communicating and transmitting, or extending motive power, by means whereof carriages or wagons may be propelled on railways or roads, and vessels may be propelled on canals, for which improved methods, &c., letters patent were granted to the said H. Pinkus, dated March 1, 1834.—Aug. 17.

Paddle Wheels.—E. Galloway, of Wellington-terrace, Waterloo-road, Surrey, for improvements in paddle wheels.—Aug. 18.

Boots and Shoes.—W. Johnson, of the Horsley Iron-works, Stafford, gent., for improvements in the construction of boots and shoes.—Aug. 22.

Steam Engines.—W. Lucy, of Birmingham, miller, for improvements in steam engines.—Aug. 24.

Mechanical Power.—T. Schwartz, technologist, formerly of Stockholm, but now of Bradford-street, Birmingham, for a practical application of known principles to produce mechanical power.—Aug. 24.

Files.—C. Appleby, of Sheffield, merchant, for improvements in manufacturing files.—Aug. 25.

Navigation.—J. L. Higgins, of Oxford-street, Middlesex, Esq., for improvements in the construction of vessels for navigation.—Aug. 26.

Sugar Manufacture.—J. F. Saunders, of Tenterden-street, Hanover-square, for improvements in clarifying and bleaching raw cane and other vegetable and saccharine juices, being a communication from a foreigner residing abroad.—Sept. 1.

Soap.—J. J. C. Sheridan, of Walworth, Surrey, chemist, for an improvement in the manufacture of soap. Sept. 17.

Wheel Carriages.—W. Mason, of Brecknock-terrace, Camben-town, engineer, for improvements on wheels, boxes, and axletrees of carriages on common roads and railways. Sept. 24.

Small-wares.—J. P. Westhead, of Manchester, small-ware manufacturer, for improvements in the manufacture of small-wares, and an improved arrangement of machinery for covering or forming a case around any wire, cord, gut, thread, or other substance.—Sept. 24.

Boilers.—J. Spiller, of Battersea, engineer, for improvements upon boilers for generating steam, or heating water or other fluids.—Sept. 24.

Bobbin Net.—W. S. Henson, of Chard, Somerset, machinist, for improvements in machinery used for making bobbin-net lace.—Oct. 1.

Woollen Cloths.—E. Hoare, of Stonehouse, Gloucester, clothier, for a method of preventing the darkness of colour which frequently occurs near the lists as compared with the colour of the middle of woollen cloths, in the process of heating them in water, or by steam on rollers.—Oct. 1.

Looms.—J. Bullough, of Blackburn, Lancaster, mechanic, for improvements in hand-looms and power-looms.—Oct. 1.

Smelting Iron.—C. P. Devaux, of Fenchurch-street, London, merchant, for improvements in smelting iron, stone, or iron ore; being a communication from a foreigner residing abroad.—Oct. 8.

Looms.—A. Howard, of Stockport, Chester, cotton-spinner, and J. Scattergood, of Manchester, machine-broker, for their improvements in looms for weaving, by hand or other power.—Oct. 8.

Horse-shoes.—T. Jevons, of Liverpool, merchant, for improved machinery in manufacturing bar or wrought iron into shoes for horses, and into other shapes; being a communication from a foreigner residing abroad.—Oct. 8.

Ornamental Stands.—R. Jupe, of New Bond-street, Hanover-square, upholsterer, for improvements in ornamental dessert, flower, and other stands.—Oct. 9.

Subaqueous Machinery.—J. W. Fraser, of Ludgate-hill, London, artist, for improvements in raising weights or substances from below to the surface of the water.—Oct. 15.

Printers' Ink.—J. Bird, of Birmingham, gent., for an improved method of making and compounding printers' ink, paints, and other pigments.—Oct. 15.

Weaving.—S. Draper, of Basford, Nottingham, for improvements in producing plain or ornamental weaving.—Oct. 15.

Iron Manufacture.—D. Mushet, of Coleford, Gloucester, iron-master, for an improvement in the art of manufacturing bar iron or malleable iron.—Oct. 22.

Fire-arms.—S. Colt, of Ludgate-hill, London, gent., for improvements in fire-arms.—Oct. 22.

Reels.—R. Barber, of Leicester, cotton-winder, for an improvement in reels for reeling.—Oct. 22.

Pin-making.—S. Slocum, of New-road, St. Pancras, engineer, for improvements in machinery for making pins.—Oct. 22.

Fining Liquids.—J. Dyer, of Mark-lane, London, merchant, for improvements in fining liquids; being a communication from a foreigner residing abroad.—Oct. 22.

Tanning.—W. Patterson, of Dublin, gent., for an improvement in converting hides and skins into leather by the application of matter obtained from a material not hitherto used for that purpose.—Oct. 22.

Engraving.—G. Baxter, of Charterhouse-square, engraver, for improvements in producing coloured steel-plate, copper-plate, and other impressions. Oct. 23.

Dressing Cloths.—J. Walton, of Sowerby-bridge, Halifax, York, frizer, for improvements for dressing, finishing, and setting the face on woollen or other cloths.—Oct. 23.

Combing.—J. Baring, of Bishopsgate-street, London, Esq., for a machine for combing or brushing wool, flax, and other fibrous materials, into teeth set in a cylinder, or otherwise; being a communication from a foreigner residing abroad.—Oct. 23.

Carding.—J. Birkby, of High Town, near Leeds, card-maker, for improvements in machinery for pointing wire cards and pins.—Oct. 29.

Ploughs.—J. Springall, of Oulton, Suffolk, iron-founder, and R. Ransome, of Ipswich, for an improved mode of manufacturing of certain parts of ploughs.—Nov. 2.

Sowing Machine.—W. Keene, of Bankside, Surrey, engineer, for improvements in machinery for sowing corn, grain, and other seeds, and manuring land; being a communication from a foreigner residing abroad.—Nov. 2.

Consuming Smoke.—J. Chanter, of Earl-street, London, and of Upper Stamford-street, Surrey, Esq., and J. Gray, of Liverpool, engineer, for an improved furnace for consuming smoke and economizing fuel, applicable to locomotive carriages, steam-boats, &c.—Nov. 2.

Bobbin-Net.—W. Crofts, of Radford, Nottingham, machine-maker, for improvements in machinery for making bobbin-net lace.—Nov. 4.

Scouring.—J. Whitehead, of Old Brompton, Middlesex, chemist, for improvements in scouring and cleaning.—Nov. 5.

Locomotion.—T., Earl of Dundonald, of Regent's Park, for improvements in machinery applicable to locomotion.—Nov. 5.

Docks and Quays.—H. Adcock, of Birmingham, engineer, for improvements at docks and quays to facilitate the importation and exportation of merchandise.—Nov. 5.

Motive Machinery.—W. Symington, of Bromley, Middlesex, cooper, for improvements in the machinery for propelling vessels by steam, parts of which are also applicable to motive machinery of other descriptions.—Nov. 7.

Knitting.—J. Wilde, late of New York, now of Manchester, merchant, and J. Whitworth, of the latter place, engineer, for machinery for knitting stockings; being partly a communication from a foreigner residing abroad.—Nov. 10.

Cylinder Printing.—T. Gregg, of Rose Bank, Bury, Lancaster, calico printer, for a mode of embossing and printing at the same time, by a cylinder, on fabrics of cotton, silk, flax, hemp, or wool, or on paper.—Nov. 10.

Depth of Water.—J. Ericsson, of Albany-street, Regent's Park, civil engineer, for an instrument for ascertaining the depth of water in seas and rivers.—Nov. 14.

Subaqueous Machinery.—J. W. Fraser, of Ludgate-hill, for improvements in apparatus for descending under water.—Nov. 14.

Ornamental Walls.—N. Troughton, of Broad-street, London, gentleman, for an improvement in finishing ornamental walls, being a communication from a foreigner residing abroad.—Nov. 14.

Embroidering.—J. Cropper, of Nottingham, lace manufacturer, and T. B. Milnes, of Lenton Works, bleacher, for improvements in machinery for embroidering bobbin-net, or lace, or clothes, stuff, or other fabrics, being a communication from a foreigner residing abroad.—Nov. 14.

Fermentation.—J. J. C. Sheridan, of Walworth, Surrey, chemist, for improvements in the several processes of saccharine, vinous, and acetous fermentations.—Nov. 17.

Silk Printing.—C. P. Chapman, of Cornhill, zinc-manufacturer, for improvements in printing silks, calicoes, and other fabrics.—Nov. 24.

Water-proof Articles.—J. Hellewell, of Springfield, Salford, Lancaster, dyer, for an improved process whereby cotton, and certain other fabrics and materials, may be rendered impervious to water.—Nov. 28.

Buttons.—H. Jefferies, of Birmingham, goldsmith and jeweller, for improvements in buttons.—Nov. 28.

Bobbin-Net.—T. R. Sewell, of Carrington, Nottingham, lace-manufacturer, for improvement in machinery for making lace called bobbin-net.—Dec. 2.

Lace-making.—J. Cropper, of Nottingham, lace-manufacturer, and T. Brown Milnes, of Lenton-works, Nottingham, bleacher, for improvements in machinery for manufacturing lace or bobbin-net lace.—Dec. 3.

Patterns for Pottery.—William Wainwright Potts, of Burslem, Stafford, for an improved method of producing patterns to be transferred to earthenware, porcelain, china, glass, and other similar substances.—Dec. 3.

Calico Printing.—B. Woodcroft, of Ardwick, Manchester, gentleman, for improvements in printing calicoes and other fabrics.—Dec. 3.

Rail-roads.—T. Parkin, of Dudley, Worcester, gentleman, for improvements in sleepers or bearers applicable to rail-roads.—Dec. 3.

Lighting.—A. Gordon, of Fludyer-street, Westminster, and J. Deville, of the Strand, lamp-manufacturer, for improvements in the production, maintenance, direction, or distribution of lights.—Dec. 3.

Building.—R. Witty, of Stoke-upon-Trent, Stafford, civil engineer, for improved methods of constructing houses, bridges, and other buildings.—Dec. 3.

Steam and Gas Gauges.—J. Radley, of Oldham, Lancaster, gentleman, for improvements in the construction of gauges for measuring the xp[illegible] pr[illegible] of [illegible] ela[illegible] apours or gases used expansively as a medium of power.—Dec. 4.

Looms.—M. Berry, of No. 66, Chancery-lane, for improvements in power-looms for weaving; being a communication from a foreigner residing abroad.—Dec. 5.

Anti-Attrition.—N. Partridge, near Stroud, Gloucester, gentleman, for an anti-attrition for the bearings of wheels and machinery generally.—Dec. 7.

Water-proof Articles.—R. W. Sievier, of Henrietta-street, Cavendish square, gentleman, for an improved water-proof cloth or fabric made either elastic or non-elastic, and for an improved manufacture of water-proof hats or caps.—Dec. 7.

Oil Paints.—N. Partridge, near Stroud, Gloucester, gentleman, for improvements in mixing and preparing oil paints.—Dec. 8.

Iron Manufacture.—J. S. Dawes, of Birmingham, Warwick, iron-master, for improvements in the manufacture of iron.—Dec. 9.

Carding.—J. Horsfall, and J. Kenyon, of Addingham, York, cotton-spinners, for improvements in engines for carding cotton, wool, and other fibrous substances.—Dec. 9.

Bobbin-Net.—J. Bertie, of Basford, Nottingham, lace-maker, for improvements in machinery for making bobbin-net lace, part of which improvements are in extension of improvements, for which Letters Patent were grated to him and one J. Gibbons, dated the 5th of June, 1834.—Dec. 9.

Drawing-frames.—J. Houldsworth, of Glasgow, cotton-spinner, for improvements in drawing and shibbing frames, in the manufacture of cotton and other fibrous substances; being a communication from a foreigner residing abroad.—Dec. 9.

Calico Printing.—L. Simpson, of Manchester, chemist, for an improvement in the preparation of colours for printing cotton and other fabrics.—Dec. 10.

Chemistry.—Frederick Hempel, of Prainenburg, in the kingdom of Prussia, doctor of chemistry, now residing in Great Portland-street, for improvements in oxidizing or oxidinizing certain animal or vegetable substances, for separating them in several parts.—Dec. 15.

Spinning.—D. Dewhurst, of Preston, Lancaster, flax-spinner, and T. Hope, J. Hope, and I. Hope, all of Manchester, Lancaster, mechanics, for improved machinery for spinning flax, hemp, cotton, silk, and other fibrous substances by power.—Dec. 16.

Steam Carriages.—W. Carpmael, of Crawford-street, gentleman, for improvements in locomotive steam-carriges, being a communication from a foreigner residing abroad.—Dec. 16.

Rivets, &c.—R. Griffiths, of Birmingham, Warwick, for improvements in machinery for making rivet, screw, blanks, and bolts.—Dec. 16.

Locomotive Carriages.—W. Coles, of Charing Cross, Esq., for improvements applicable to locomotive carriages.—Dec. 16.

Weaving.—J. Osbaldeston, of Blackburn, Lancaster, weaver, for an improved method of making a metal heald or healds for the weaving of silk, woollen, worsted, cotton, or any other fibrous substance.—Dec. 16.

Getting up Lace.—O. Topham, of Whitecross-street, engineer, for improvements in dressing, starching, cleaning, and drying lace or net.—Dec. 16.

Lock.—J. Warwick, of No. 9, Three Kings-court, Lombard-street, merchant, for an improved lock and key; being a communication from a foreigner residing abroad.—Dec. 16.

Railway Carriages.—H. Booth, of Liverpool, gentleman, for an improved method of attaching railway carriages together.—Dec. 16.

Harps.—P. Erard, of Great Marlborough-street, for certain improvements on harps.—Dec. 18.

Steam-Vessels.—J. Baillie, of Great Suffolk-street, Southwark, engineer, and J. Paterson, of Mincing-lane, London, gentleman, for improvements in propelling of vessels and other floating bodies by means of steam or other power.—Dec. 21.

Musical Instruments.—T. Howell, of Clare-street, Bristol, for improvements in musical instruments.—Dec. 21.

Copper Smelting.—N. Troughton, of Broat street, London, mer-

chant, for improvements in obtaining copper from copper ores.—Dec. 22.

Spirituous Liquors.—J. T. Betts, of Smithfield Bars, London, rectifier, for improvements in preparing spirituous liquors in the making of brandy; being a communication from a foreigner residing abroad.—Dec. 22.

Weaving.—J. Heathcoat, of Tiverton, Devon, lace manufacturer, for weaving divers kinds of goods and wares, and for machines or machinery applicable thereto.—Dec. 21.

SCIENTIFIC BOOKS PUBLISHED IN 1835.

Acret's Treatise on Hernia—Aldis' Introduction to Hospital Practice—Alphabet of Physical Geography for Beginners—Asiatic Researches, (Index to first 18 vols.)—Audubon's Ornithological Biography, vols. 2 and 3—Baines' History of the Cotton Manufacture—Barlow's Experiments on the Strength of Malleable Iron—Barlow's Second Report on Railways—Baxter's Agricultural and Horticultural Annual, 1836—Belcher's Treatise on Naval Surveying—Bertrand's Revolutions of the Globe described—Black's Treatise on Brewing, &c.—Book of Reptiles—Bostock's Sketch of the History of Medicine—Bridgewater Treatise, (Kirby on Animals,) 2 vols.—British Botany explained, &c., in Dialogues—Brougham's (Lord) Discourse on Natural Theology—Burnett's Outlines of Botany—Byrne's Treatise on Spherical Trigonometry—Chadwick's Practical Treatise on Brewing—Clark's (Jas.) Treatise on Consumption and Scrofula—Cock's (Edw.) Student's Guide for Dissecting—Cock's Illustrations to Cooper's Surgical Dictionary, 2 vols.—Collins's Observations on Midwifery—Conwell's Treatise on Changes of the Liver, &c.—Cooper's (Wm.) Glass Cutter and Glazier's Manual—Cooper's (Sir A.) Principles and Practice of Surgery—Crosse's Treatise on Urinary Calculus—Curtis' British Entomology, vol. 12—Cuvier's Animal Kingdom, by Griffiths, &c., (Index, &c.)—Cuvier's Animal Kingdom, by Griffiths, &c.—Cyclopædia of Practical Medicine, vol. 4—Davies' (Thos.) Lectures on Diseases of the Lungs, &c.—Davy's Experimental Guide to Chemistry—De la Beche's How to Observe; Geology—Dennis's Landscape Gardener—Earl's Treatise on Disorders of Neat Cattle—Elliotson's Human Physiology, part 1—Everard's Flowers from Nature—Examples on the Integral Calculus—Field's Treatise on Colours and Pigments—First Book of Geometry—Galbraith's Cotton Spinner's Companion—Gandee's Young Ladies' Instructor in Painting, &c.—Grant's (R. E.) Comparative Anatomy, parts 1 and 2—Green's (J.) Compendium of the Diseases of the Skin—Green's (A.) Essay on the Nature of Diseases—Griffith's (Wm.) Treatise on Water in the Brain—Hakewill's Essay on Elizabethan Architecture—Hartley's (Jos.) Wine and Spirit Merchants' Guide—Heeren's Manual of Ancient Geography—Herrison on the Sphygmometer, by Dr. Blundell—Higgins' (W. M.) Physical Condition, &c. of the Earth—Higgins' (C.) on Climate, Diet, &c. of England and France—Hilles' British Dissector, part 1—Hind on Fractures of the Extremities—History of Fossil Fuel, Collieries, &c. of Great Britain—Hoare's Treatise on the Grape Vine—Hodgkin on Promoting and Preserving Health—Hope's (Thos.) History of Architecture

&c., 2 vols.—Hope's (Thos.) History of Architecture, &c. (Analytical Index to)—Hume's (G. L.) Essay on Chemical Attractions—Hutchison's Treatise on Meteorological Phenomena—Introduction to the Study of Birds—Inwood's Studies of the Architect, from Nature—Jardine and Selby's Ornithology, part 10—Jardine's Naturalist's Library, vols. 7 to 11—Jenyns' Manual of British Vertebrate Animals—Jesse's Gleanings in Natural History, vol. 3—Journal of the Royal Geographical Society, vols. 4 and 5—Kingston's System of Painting in Dry Colours—Koecker's Essay on Artificial Teeth—La Croix's Algebra, translated by Spiller—Laurance's Geology in 1835—Louis on Consumption, translated by Cowan—Magendie's Formulary, translated by Dr. Gully—Magendie's Formulary, translated by Dr. Gregory—Main's Popular Botany—Mallan's Physiology of Diseases of the Teeth—Marshall's (Dr. J.) Observations on Diseases of the Heart, &c.—Mayo's Outlines of Human Pathology, part 1—Memoirs of the Royal Astronomical Society, vol. 8—Minerals and Metals; their Natural History, &c.—Mudie's "The Heavens"—Mudie's "The Earth"—Mudie's "The Air"—Mudie's "The Sea"—Murray's (John) Tables and Diagrams, (Chemistry, &c.)—Newman's (Edw.) Grammer of Entomology—Oke's Observations on Surgery, &c. part 2—Osborne's Nature and Treatment of Dropsies—Pambour's Treatise on Locomotive Engines—Partington's Introduction to Botany—Ditto, with 14 plates—Pearson (R.) on Action of the Broom Seed in Dropsy—Popular Illustrations of Natural History—Proceedings of the British Association, 1834—Quetelet's Natural Philosophy, translated by Wallace—Ramage's Treatise on Asthma—Rayer on Diseases of the Skin—Atlas to do.—Reid's (Jas.) Manual of Practical Midwifery—Report of the British Association Meetings in Dublin—Roberts' (W. H.) British Wine Maker and Domestic Brewer—Robertson's (Wm.) Treatise on Diseases of the Teeth—Robertson's (W. H.) Treatise on Diet and Regimen—Savory's Companion to the Medicine Chest—Search's Metaphysic Rambles, parts 1 and 2—Smeaton's Painter's, Gilder's, and Varnisher's Manual—Smith's (Southwood) Philosophy of Health, vol. 1—Snowball's Elements of Spherical Trigonometry—Spender on Ulcerous Diseases of the Leg—Stanley's History of Birds, 2 vols.—Stevenson's Treatise on Algebraic Equations—Stewart's (R. B.) Outlines of Botany—Surenne's French Grammatology, 3 vols.—Thomson's (Thos.) Outline of Mineralogy, Geology, &c., 2 vols.—Transactions of the Cambridge Philosophical Society, vol. 5, part 3—Ditto Geological Society, vol. 3, part 3, and vol 4, part 1—Ditto Horticultural Society, 2nd series, part 5, 6, and 7—Ditto Institution of Civil Engineers—Ditto Linnæan Society, vol. 17, part 2—Ditto Medical and Chirurgical Society, vol. 19—Ditto Philosophical Society, 1834, part 2—Ditto ditto, 1835, parts 1 and 2—Ditto Society of Arts, vol. 50, part 1—Ditto Zoological Society, vol. 1,—Ditto ditto (Proceedings of) part 4—Turnbull's Medical Properties of the Ranunculaceæ—Tyrrell on Consumption—Underwood's Medical Student's Guide, &c.—Ure's Philosophy of Manufactures—Waite on the Structure, Growth, &c. of the Gums—Wardrop on Blood-letting—Watson's New Botanist's Guide, (England and Wales)—Watson's Geography of British Plants—Waud's Algebraical Geometry, (Lib. of Useful Knowledge)—Weatherhead's Treatise on Headaches—Webster's Principles of Hydrostatics, &c.—Wesley's Compendium of Logic, by T. Jackson—Willats' Florist's Cultivator—Williams' (R. F.) Art of Sculpture on Wood—Willis' (R.) Architecture of the Middle Ages—Wilson's (Jas.) Treatise on Insects—Woodhouse on

Musical Intervals and Harmonics—Wright's (J. M. F.) Algebraic System of Conic Sections—Young's Treatise on Algebraical Equations—Young's Treatise on Algebra, (Key to, by Spiller).—*From Bent's Literary Advertiser.*

OBITUARY OF PERSONS EMINENT IN SCIENCE AND ART, 1835.

BARON DUPUYTREN, the celebrated French anatomist.

M. DURAND, architect, author of *Parallele des Edifices*.

HENRY BONE, R.A., the distinguished enamel painter.

FREDERICK WILLIAM SMITH, sculptor.

REV. R. T. MALTHUS, the political economist.

HENRY BANKS, Esq., one of the Trustees of the British Museum.

JOHN NASH, Esq., architect, distinguished by the improvements which he carried into effect, in the metropolis and its environs—witness Regent Street, the Regent's and Saint James's Parks.—*Literary Gazette.*

EDWARD TROUGHTON, Esq., fellow of several Learned Societies, and distinguished for his admirable productions of glasses and instruments for astronomical and other observations. He is the author of a paper in the *Philosophical Transactions* for 1809, entitled "an Account of a Method of dividing Astronomical and other Instruments by ocular inspection; in which the usual tools for graduating are not employed; the whole operation being so contrived, that no error can occur but what is chargeable to vision when assisted by the best optical means of viewing and measuring minute quantities." The intrinsic excellence of Mr. Troughton's method, as detailed in this paper, consists in the process of examination employed to correct the imperfections in laying down the divisions by methods which give only approximate degrees of accuracy.—Report of the Anniversary of the Royal Society, in the *Philosophical Magaizne*, No. 45.

ROBERT LEMON, Esq., F.S.A., of the State Paper Office.

GILBERT T. BURNETT, Esq., Professor of Botany in King's College, London, and one of the most successful botanical writers of his time.

CHARLES WILD, Esq., the clever and well-known artist.

GILBERT STUART NEWTON, Esq., R. A.

DR. M'CULLOCK, geologist, known by several works of considerable scientific value and importance.

FRANCIS GOODWIN, Esq., architect.

MR. JAMES DRUMMOND, the botanist.

SIR JOHN SINCLAIR, Bart., the distinguished political economist, and writer on agriculture.

DR. GERARD, the Eastern traveller.

DR. ROZENMULLER, the Oriental Professor, of Leipsic.

M. BOETTIGGER, the distinguished German archæologist.

BARON WILLIAM VON HUMBOLDT, antiquarian and philologist, brother to the celebrated traveller.

SIR WILLIAM BLIZARD, F.R.S. the eminent surgeon.

DR. WILLIAM TURTON, translator of Linnæus's *General System of Nature*, and author of several valuable works.

MR. WILLAM SAY, mezzotinto engraver.

CAPTAIN HENRY KATER, contributor of fifteen papers to the *Philoso-*

phical Transactions. Amongst the scientific labours of Capt. Kater, is a serious of investigations of several years' duration, relative to the Pendulum, several of which have been noticed in previous volumes of the *Arcana*: they rank amongst the most valuable contributions to physical science in our time. One of the greatest benefits conferred on science by Capt. Kater, was his invention of the floating collimator, an instrument to determine the situation of the line of collimation of a telescope attached to an astronomical circle, with respect to the zenith or the horizon in any one position of the instrument; or, in other words, to determine the zero point of the divisions of the limb; an operation which was before usually performed by the use of the level or plumb-line, or from the reflection of an object from the surface of a fluid. Each of these methods was liable to many inconveniences and defects; all of which are avoided in the floating collimator. From the greater degree of precision attainable by the employment of this instrument, from the facility of its construction, the readiness of its application, and the economy of time resulting from its use, the employment of the level and plumb-line may be wholly superseded. Abridged from the Report of the Anniversary of the Royal Society, in the *Philosophical Magazine*, No. 45.

John Brinkley, Lord Bishop of Cloyne, and formerly Andrews Professor of Astronomy in the University of Dublin. His Lordship contributed several papers to the *Philosophical Transactions*, the last of which, (in 1826,) communicated the results of the application of Capt. Kater's floating collimator to the astronomical circle of Trinity College, Dublin. He regards the results of these observations as highly favourable to the principle of the collimation, which he considers as a new astronomical power, and as even belonging to a more advanced era of practical astronomy than the present.—*Ibid.*

Mr. James Frost, of the Exotic Nursery, near Leamington Priors, whose whole life had been devoted to the study and practice of horticulture and botany.

Mr. Robert Sweet, F.L.S. author of *The British Warblers*, and of several botanical works of high interest.

Uhden, the German antiquary.

Chr. G. Crelle, Prussian architect.

Godescharles, Belgian sculptor.

Roman, French sculptor.

Alexander Dufour, French architect.

Henry Parke, architect.

D. F. H. Müller, artist.

Professor Martos, the Russian Canova.

Garavaglia, an Italian engraver.

Baron Gros, the eminent French historical painter.

Mr. David Douglas, an eminent and zealous naturalist. Among his botanical discoveries were two stupendous pines, Pinus Douglasii, and Pinus Lambertiana: he also introduced into this country the Oxalis Crenata; and "no man," says Mr. Loudon, "ever introduced so many hardy plants into Britain, as Mr. Douglas." He died in the Sandwich Islands, where having fallen into a pit dug for catching wild bulls, he was gored by a bull in the pit, so as to cause his death.

In October, 1834, Mr. Say, the distinguished American entomologist: he was one of the earliest members, if not one of the founders, of the Academy of Natural Sciences, at Philadelphia.

MEETINGS OF THE LITERARY AND SCIENTIFIC INSTITUTIONS OF LONDON FOR 1835—36.

Societies.	Times of Meeting	November.	December.	January.	February.	March.	April.	May.	June.
Royal Society -	Thur. 8½ P. M.	19, 26	10, 17	7, 14, 21, 28	4, 11, 18, 25	3, 10, 17, 24	14, 21, 28	5, 12, 19	2, 9, 16
Society of Antiq.	Thur. 8 P. M.	19, 26	3, 10, 17	7, 14, 21, 28	4, 11, 18, 25	3, 10, 17, 24	14, 28	5, 12, 19	2, 9, 16
Royal Institution	Fri. 8½ P. M.	..	..	22, 29	5, 12, 19, 26	4, 11, 18, 25	15, 22, 29	6, 13, 20, 27	3, 10
Royal Geog. Soc.	Mon. 9 P. M.	23	14	11, 25	8, 22	14, 28	11, 25	9, 23	13, 27
Geological Society	Wed. 8½ P. M.	4, 18	2, 16	6, 20	3, 24	9, 23	13, 27	11, 25	8
Linnæan Society	Tues. 8 P. M.	3, 17	1, 15	19	2, 16	1, 15	5, 19	3	7, 21*
Horticul. Society	Tues. 1 P. M.	3	1	19	2, 16	1, 15	5, 19	3, 17	7, 21*
Zoological Soc.	Thur. 3 P. M.	5	3	7	4	3	7	5	2*
Zoological Soc.	Tues. 8½ P. M.	10, 24	8, 22	12, 26	9, 23	8, 22	12, 26	10, 24	14, 28
Entomolog. Soc.	Mon. 8 P. M.	2	7	4	1	7	4	2	6
Statistical Society	Mon. 8 P. M.	16	21	18	15	21	18	16	20
Astronomical Soc.	Fri. 8 P. M.	13	11	8	..	11	8	13	10
Phrenolog. Soc.	Mon. 8 P. M.	2, 16	7, 21	4, 18	1, 15	7, 21	4, 18	2, 16	6, 20
Society of Arts	Wed. 7½ P. M.	4, 11, 18, 25	2, 9, 16, 23	6, 13, 20, 27	3, 10, 17, 24	2, 9, 16, 23, 30	6, 13, 20, 27	4, 11, 18, 25	1, 8
Society of Arts	Tues. 8 P. M.	10	8	12	9	8	12	10	16
Royal Soc. of Lit.	Thur. 4 P. M.	12, 26	10, 24	14, 28	11, 25	10, 24	14	12, 19	9, 23
Royal Asiatic Soc.	Sat. 2 P. M.	..	5, 19	2, 16	6, 20	5, 19	16	21	4, 18
Royal Col. of Phy.	Mon. 9 P. M.	..	..	25	29	28	25	30	27
Royal Med. and Chirurg. Soc.	Tues. 8½ P. M.	10, 24	8, 22	12, 26	9, 23	8, 22	12, 26	12, 24	..
Med.-Bota. Soc.	Tues. 8 P. M.	10, 24	8, 22	12, 26	9, 23	8, 22	12, 26	10, 24	14, 28
Medical Society	Mon. 8 P. M.	2, 9, 16, 23, 30	7, 14, 21	4, 11, 18, 25	1, 8, 15, 22, 29	7, 14, 21, 28	11, 18, 25	2, 9, 16, 23, 30	..
Harveian Society	Mon. 8 P. M.	2, 16	7, 21	4, 18	1, 15	7, 21	4, 18	2, 16	6, 20
West. Med. Soc.	Sat. 8 P. M.	7, 14, 21, 28	5, 12, 19	2, 9, 16, 23, 30	6, 13, 20, 27	5, 12, 19, 26	9, 16, 23, 30	7, 14, 21, 28	..
Institution of Civil Enginr.	Tues. 8 P. M.	..	..	12, 19, 26	2, 9, 16, 23	1, 8, 15, 22	5, 12, 19, 26	3, 10, 17, 24, 31	7, 14

ANNIVERSARIES.—Royal, Nov. 30, 11 A.M.—Antiquaries, April 23, 2 P.M.—Royal Institution, May 1.—Royal Geographical, May 16. [illegible] P.M.—Geological, Feb. 19, 1 P.M.—Linnæan, May 17, 8 P.M.—Horticultural, May 1, 1 P.M.—Zoological, April 29, 1 P.M.—Statistical Society, March 15, 3 P.M.—Astronomical, Feb. 12, 3 P.M.—Phrenological, March 31, 8 P.M.—Royal Society of Literature, April 28, 4 P.M.—Asiatic, May 7, 1 P.M.—College of Physicians (Harveian Oration), June 25, 4 P.M.—Royal Medical and Chirurgical Society, March 1.—Medico-Botanical, Jan. 16, 8 P.M. The Annual Meeting of the British Association for the Ad-

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MECHANICAL AND GENERAL SCIENCE.

CHEMICAL SCIENCE.

RURAL ECONOMY.

GARDENING.

DOMESTIC ECONOMY.

MISCELLANIES.